The Journal of the Association of Schools and Colleges of Optometry

OPTOMETRIC EDUCATION

Volume 29, Number 2

Winter 2004

Genomics — The Future of Eyecare

Association of Schools and Colleges of Optometry

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OPTOMETRIC EDUCATION

ISSN 0098-6917

VOL. 29
NO. 2

WINTER
2004

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Cover photo: Visual Eyes, Storytellers for the Digital Age, Westlake Village, CA

OPTOMETRIC EDUCATION is published by the Association of Schools and Colleges of Optometry (ASCO). **Managing Editor:** Patricia Coe O'Rourke. **Art Director:** Carol Nansel, Nighthawk Communications. Business and editorial offices are located at 6110 Executive Boulevard, Suite 510, Rockville, MD 20852 (301) 231-5944. The ASCO website is www.opted.org **Subscriptions:** JOE is published three times a year distributed at no charge to dues-paying members of ASCO. Individual subscriptions are available at $30.00 per year, $40.00 per year to foreign subscribers. Postage paid for a non-profit, tax-exempt organization at Rockville, MD.

Indexed in Current Index to Journals in Education (ERIC).

Guest

EDITORAL

What Is Genomics and Why Is It Important?

Leland W. Carr, O.D.

Microcellular physiology and human genetics have rocketed to high-profile status largely as the result of the remarkably successful Human Genome Project. We have come to realize that by working at the microscopic and submicroscopic levels we can gain diagnostic insights and can achieve therapeutic interventions that just a few years ago we would never have thought possible. The genomics revolution is already dramatically impacting the health sciences. Soon it will drive the delivery of clinical care.

It is important for Optometry to be part of the genomics movement because to ignore it is to write our own funeral notice. The emerging insight into novel ways to affect change, literally from the cellular building-block level to the whole body, macro functional level, is destined to change our standards for delivering care.

The ability to realistically assess risk factors by evaluating a patient's genetic profile will make it possible to make diagnoses at much earlier points in time. This will then lead to the use of tests based on sound data confirming that such expense is warranted.

More rapid intervention will mean greater odds of success. Ultimately the ability to identify genetic predispositions and microcellular abnormalities will make it possible to change the irregularities and to redirect the future development and function of the patient's cells, tissues, and organs. It will be like viewing a patient's future by analyzing his/her personal lifelong biography on DVD, and then having the means to rewrite that program's script before reaching the unpleasant chapter in the patient's life.

Why genomics? Why is it important? Because it is the future of health care.

Convinced of the importance of genomics to the future of the profession, ASCO invited Dr. Charles Wormington, an associate professor of biophysics and optometry at the Pennsylvania College of Optometry, whose paper you will find in this issue, as ASCO's guest speaker at its June 2003 Annual Meeting Luncheon in San Diego. Deans, presidents, faculty, student and other optometric leaders listened raptly to Dr. Wormington's presentation on "The Genomics Revolution and the Future of Optometric Practice."

In its role as an awareness builder, ASCO commissioned the design of a state-of-the-art DVD that develops Dr. Wormington's ideas further with accompanying dynamic visual effects. The DVD is being distributed to the schools and colleges of optometry, to AOA state and national leaders and to related optometric groups.

I want to express special thanks to Dr. Stanley Yamane and to Vistakon, a Division of Johnson & Johnson Vision Care, Inc., for their invaluable support for this project. An educational grant from Vistakon® made possible the development of the DVDs and this special issue of *Optometric Education* on genomics.

Future plans include a mini-symposium for ASCO Board members and their institutional invitees at the March 2004 Board meeting where Dr. Wormington will lead invited guests forward to consider needed actions in the curriculum, residency programs, faculty development and continuing education programs that support the incorporation of genomics into optometry. I am also strongly recommending that ASCO then plan a workshop for bioscience educators and chief academic officers at the American Academy of Optometry meeting in December 2004 and a spring 2005 Educators Summit on Genomics Core Curriculum Design for Optometry.

Optometric education must be a vital player in this momentous movement.

Dr. Carr is president of the Association of Schools and Colleges of Optometry.

Letters to the Editor

Diversity Task Force

The Fall 2003 edition of *Optometric Education* contains at least two references to an ASCO task force on diversity in optometry schools. We live in an era when "diversity" is one of the most pervasive concepts in academic life, but so are "outcome measures."

I have never read anything about the concept of outcome measures as applied to diversity. I am not speaking of the identification of the existence of diversity. That's easy; just take a census.

Instead, I would like to see a declaration of what it is, exactly, that diversity is expected to achieve in academia. How will it alter the quality of our graduates; what will it enable them to do that they can't do already; what outcomes do we expect it to generate and how would those outcomes be measured? These extremely important questions would undoubtedly be applied to any other major curricular initiative that we undertake - so.....

Paul Abplanalp, O.D.
Associate Dean for Academic Affairs
Nova Southeastern University
College of Optometry

ASCO Response

Diversity in academia is crucial if we hope to serve the needs of our democratic society in which equality of rights and opportunity is fundamental. ASCO's interest in this area was confirmed as recently as the fall 2003 Board meeting where the Board recommended revising ASCO's mission statement to include language on diversity and multiculturalism. Likewise they encouraged ASCO member institutions to"strongly consider including verbiage regarding diversity and multiculturalism as part of each institution's mission statement." The outcomes of a diverse or multicultural educational environment are compelling because:

- Diversity enriches the educational experience. We learn from those whose experiences, beliefs, and perspectives are different from our own, and these lessons can be taught best in a richly diverse intellectual and social environment.
- Diversity promotes personal growth—and a healthy society. Diversity challenges stereotyped preconceptions; it encourages critical thinking; and it helps students learn to communicate effectively with people of varied backgrounds.
- Diversity strengthens communities and the workplace. Education within a diverse setting prepares students to become good citizens in an increasingly complex, pluralistic society; it fosters mutual respect and teamwork; and it helps build communities whose members are judged by the quality of their character and their contributions.
- Diversity enhances America's economic competitiveness. Sustaining the nation's prosperity in the 21st century will require us to make effective use of the talents and abilities of all our citizens, including the work setting that bring together individuals from diverse backgrounds and cultures.

The disparity in the care (health) received by groups that are underrepresented in society as opposed to groups that are in the majority remains a significant problem. New efforts are being directed to closing racial and ethnic gaps. In *Unequal Treatment*, a 2002 Institute of Medicine report, an argument was made for reducing disparities by increasing the number of minorities in the health care workforce and by improving the competence of the health care workforce in working with racial, ethnic and disadvantaged populations. By achieving cultural competence, health care providers become better advocates of their cross cultural patientsí needs, better able to understand those for whom they are providing care, and better able to break down language and cross-cultural barriers that may hinder or prevent them from providing adequate care to their patients.

Studies (M. Komaromy et al, *NEJM* 1996, Moy et al, *JAMA* 1995 and Xu et al, *AM Journal of Public Health*, 1997) have shown that underrepresented racial, ethnic and disadvantaged populations are also most likely to provide professional care within underserved communities. They are more willing to treat the poor and the "sicker" patient and they treat four to five times more minority patients per licensed practitioner.

I welcome the opportunity to clarify ASCO's position on this very timely issue.

Leland W. Carr, O.D.
ASCO President

Diversity Task Force (2)

The Fall 2003 issue of *Optometric Education* presents your staff's report on optometric applications and enrollments, within which are brief accounts of your appointment of a Diversity Task Force and of a collaborative of ASCO and other health professions relating to the long-shared problem of a paucity of minority peoples in the practice of most health professions. I was very happy to read of these initiatives, and wanted to share with you some ideas and experience engendered in a quite remarkable program in which, until three years ago when we ran out of money, I was very much involved, an experience from which there may be findings that could be useful in optometry and other health professions.

We called it the "Compact for Faculty Diversity." The three regional compact organizations that existed in

1990 (Southern Regional Education Board, Western Interstate Commission for Higher Education, and New England Board of Higher Education) put together a project aimed at encouraging more students of underrepresented minorities to go on to graduate school, complete the Ph.D., and enter college teaching. We were persuaded that simply getting the scholars into graduate school was not anywhere near enough; and some six yearsí experience before money ran out in New England and in the West, demonstrated that that assumption was correct.

An evaluation in 1999 found that the project was remarkably successful and attributed that success to (essentially) three factors: (1) the Compact created a "multi-layered web of support" for minority scholars — from the department through the graduate office and the university, on through the state higher education agency and the regional organization; (2) the several hundred scholars *and their faculty mentors* came together annually for two-three days of meetings and fun, an experience that has seemed to have made an almost incredible contribution to the success of the program; and (3) the participating institutions and departments did in fact undertake specific "good practices" in bringing these scholars into departmental and institutional life.

With WICHE's (and NEBHE's) inability to continue to fund full participation, the Compact functions less formally and my own role as administrative coordinator (on a consultant basis) has come to an end (my advancing years surely had something to do with my withdrawal from firing line responsibility, also!). The program remains very much alive in the region in which the idea for it originated, under the direction of Dr. Ansley Abraham at the Southern Regional Education Board.

My own observations, both within optometric education and in the Compact for Faculty Diversity, suggest to me strongly that there is experience in the Compact for Faculty Diversity that could be of significant assistance in the health professions, as plans for action steps are made. I think the best source for further information about the Compact is the originator of the program, the director of the program at the Southern Regional Education Board, Dr. Ansley Abraham.

With cheers for the effort and every good wish to ASCO.

Frank C. Abbott, Ph.D.
Senior Policy Advisor
Western Interstate Commission for Higher Education
Boulder, Colorado

Note: Dr. Abbott is a former public member of the then-named Council on Optometric Education (COE; now ACOE)

Defibrillators at Clinical Outreach Sites

I read with great the interest the article on the availability of automated external defibrillators (AED's) at clinical outreach sites, by Drs. LaMotte and Nishimoto, in the Summer 2003 issue of *Optometric Education*. It presents an excellent overview of and rationale for the availability of AED's at clinical sites. The article does not say whether or not SCCO students are instructed in defibrillation at the school prior to going to outreach sites. It also does not indicate if defibrillators are available at SCCO's own clinics. It would seem even more important at a purely optometric site as opposed to a hospital or multidisciplinary setting where such equipment might be available quickly.

Students at the SUNY College of Optometry have been trained to use AED's as part of courses in emergency care that are offered just prior to their entrance into the third year of the professional program. They are again certified in CPR with defibrillation during the fourth year so that they have the necessary current certification that many state boards require for optometric licensure. Use of AED's was added to the course during the mid 1990's when guidelines for public access defibrillation were approved and both the American Red Cross and the American Heart Association included AED training as part of their CPR courses.

While use of an AED can certainly now be considered a "standard of care" for cardiac emergencies, it may even be more important for optometric students and optometrists to be trained to deal with other, and more common, medical emergencies they may face with their patients. CPR and first aid courses provide a good basic foundation for dealing with many types of emergencies. In institutional settings of all types, there is an increasing expectation that health care providers be prepared to act quickly when their patients suffer life-threatening emergencies.

Michael H. Heiberger, O.D., M.A.
Associate Clinical Professor
Coordinator of Emergency Care Courses
SUNY College of Optometry

Authors' Response

We wish to thank Dr. Heiberger for his kind comments regarding our article. The Southern California College of Optometry has had an automated external defibrillator (AED) available campus-wide including our clinic for several years. I (JL) have taught CPR to the first and third year students at SCCO for the past 18 years. Thus, our students are certified in CPR during their four years at SCCO. I received credentials to teach AED rescue procedures in the late 90's and then included this instruction to the third year students. Currently, the first year students also receive AED training.

We agree with Dr. Heiberger that as AEDs become more common in public venues, especially healthcare clinics, there will be an increasing expectation by the public that an AED is available. Unfortunately, this expectation could lead to lawsuits if a cardiac emergency occurs and an AED is not available. It is also important to realize that, because of changes in various state statutes, the Good Samaritan law may not protect the operator of an AED from civil lawsuit unless he/she is certified in AED rescue.

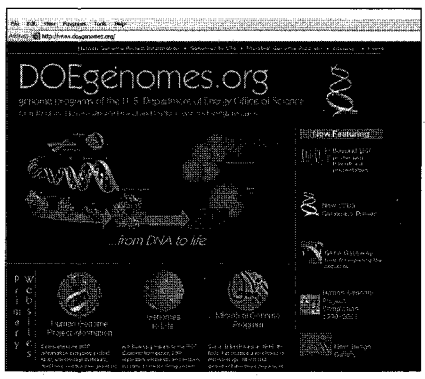
James LaMotte, Ph.D., O.D.
John Nishimoto, O.D., M.B.A.
Southern California College of Optometry

A Good Pair of Genes

Dominick M. Maino, O.D., M.Ed., F.A.A.O.
Geoffrey Goodfellow. O.D., F.A.A.O.

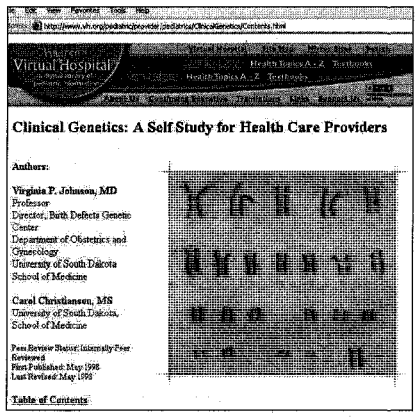
When I (DM) was growing up, a good pair of "genes" meant a stiff pair of dark blue denim pants with a "Wrangler" tag on the waist bought from Sears. Now "genes" mean something quite different to most of us when working with students and patients. Is the study of genetics important in optometry? At least one text (Fatt H, Griffin J, Lyle W. Genetics for primary eye care practitioners, 2nd ed. Boston, MA: Butterworth-Heineman, 1992.) has been written by optometrists on this subject and most academic curricula discuss genetics in the role of eye disease, human normal and abnormal development, and future diagnostic and treatment venues.

Where can you start your search about genetics? Well if you are interested in the Human Genome Project, you probably want to go to http://www.doegenomes.org/. The Department of Energy Office of Science offers the "Beyond the Human Genome Project Poster & Slide Presentation," a "Genomics Primer," and great images of genes, chromosomes, DNA and more.

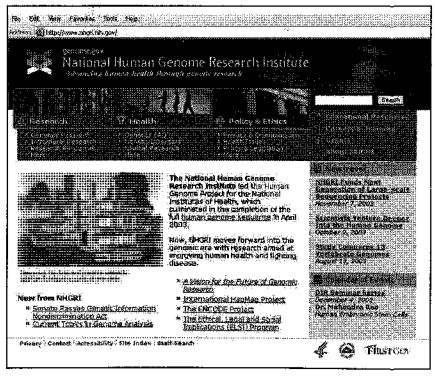


Your next stop may be at the National Human Genome Research Institute (http://www.nhgri.nih.gov/) for information on genetics research, health concerns, and governmental policy and ethics issues. For example, did you know that the US Senate has passed the "Genetic Information Non-discrimination Act"? Do you know what this bill means for our schools and colleges of optometry? Visit this site to learn more.

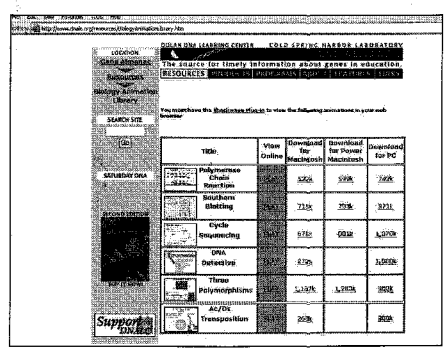
During my course on Infant and Child Development, learning how to find out information concerning genetic disorders in humans is

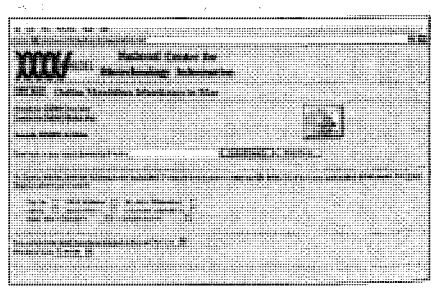


essential. I use many resources for this, but one I just recently uncovered (http://www.ornl.gov/sci/techresources/Human_Genome/posters/chromosome/ggworkbook1.pdf) is a workbook in pdf format titled the "Gene Gateway Workbook." This workbook has hands-on activities that demonstrate how to use the web to find out information that is fundamental for our students to become conversant in the language of life (genetics). This workbook uses *Online Mendelian Inheritance in Man* (http://www.ncbi.nlm.nih.gov/omim/) in its very first lesson. This particular website is my resource of choice not only for my course on developmental disabilities, but it also serves as the main informational resource I use in ICO's Developmental Disabilities Service.



If you need animations to help teach about Polymerase Chain Reaction, Southern Blot and other genetic tools, just go to the Dolan Learning Center (http://www.dnalc.org/resources/Biology AnimationLibrary.htm) for assistance. For a quick primer on Mendelian genetics visit *Basic Principles of Genetics* (http://anthro.palomar.edu/ mendel/) and finally if you want to test your own "Genetics IQ" or to brush up on your knowledge in this area go to *Clinical Genetics: A Self Study for Health Care Providers* at http://www.vh.org/pediatric/provider/pediatrics/Clinical Genetics/Contents.html for a concise review of genetics designed for the health care provider.





INDUSTRY NEWS

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Vistakon Provides Management Tools

In its latest effort to help Eye Care Professionals (ECPs) educate patients about eye health and run their practices more efficiently, VISTAKON®, Division of Johnson & Johnson Vision Care, Inc., is supplying a broad array of educational materials, including a brochure about teens and contact lenses, eye exam-reminder postcards and a training module to help office staff better manage their time. VISTAKON® is distributing the materials as part of its ACUVUE® Eye Health Advisor Program, the premier educational initiative currently available that provides ECPs with the tools they need to help educate their patients and increase customer satisfaction.

"The new ACUVUE® Eye Health Advisor materials highlight our ongoing commitment to the ECP," said Phil Keefer, president, VISTAKON® Americas. "Already, feedback has been overwhelmingly positive. ECPs can - and should - continue to look to VISTAKON® to provide them with the necessary tools that will help them better serve their patients."

The new ACUVUE Eye Health Advisor brochure is a two-part piece that addresses both parent and teen concerns about teen contact lens wear. *So Your Teen Is Considering Contact Lenses* answers many questions parents have about teen contact lens wear, including age appropriateness, ability to follow proper lens wear and care schedules, and the benefits of playing sports while wearing contact lenses. *Hey Teens....Open Your Eyes to a New You* is dedicated to teens and addresses such myths as "Does it hurt to put on and take off contact lenses?" and "Can the lens get lost behind my eye?" The brochure serves as a one-stop guide to opening the dialog between teens, their parents and their ECP on teen contact lens wear.

Moving from patient focus to practice focus, VISTAKON developed *Where Did My Day Go?*, a humorous yet educational staff-training module designed to help identify "time burglars" that rob ECPs and their staff of valuable time every day. This module provides practical and easy-to-implement ways in which ECPs and their staff can increase productivity, eliminate stress, and promote satisfaction in their eye care office. The training session includes a facilitator's guide, video, and workbook.

To help ECPs remind their patients about the importance of annual eye exams, Vistakon created "reminder" postcards that not only let patients know it's time to make an appointment, but also highlight the numerous conditions that can be detected during an eye exam. For more information, contact www.acuvue.com

CIBA: Role of Lubricating/ Rewetting Drops In Contact Lens Care

A substantial percentage of eye care professionals recommend lubricating/rewetting drops for their soft contact lens patients, according to a recent email survey conducted by Ciba Vision.

Forty-two percent of practitioners reported that they recommend drops to more than 40 percent of their contact lens patients. Overwhelmingly, 53 percent of practitioners said that they make the recommendation because patients complain of dryness. Another 19 percent cited end-of-day discomfort and 18 percent cited the local climate or environment as the key indicator.

"Lens discomfort is the number one reason why patients stop wearing contact lenses, and lens dryness is the number one complaint of contact lens wearers," said Richard E. Weisbarth, O.D., vice president, professional services, Ciba Vision North America.

Two-thirds of practitioners said that they recognize a significant clinical and/or patient-perceived difference between brands of lubricating/rewetting drops. Thirty-four

(Continued on page 62)

The Genomics Revolution and Molecular Optometry: Educational Implications

Charles M. Wormington, Ph.D, O.D., F.A.A.O.

April 2003 was a momentous time for mankind. It marked the end of the beginning of the genomic revolution. Two major milestones were celebrated that month. One was the celebration of the 50th anniversary of Watson and Crick's discovery and publication of the structure of DNA. The other milestone was the celebration of the completion of the sequencing of the human genome; all three billion base pairs have been identified as a result of the Human Genome Project (HGP). Now another monumental task lies before us –figuring out the function of all of the genes that have been sequenced.

The "Old Genetics" and the "New Genetics"

When you hear the word genetics, you probably think about single gene or Mendelian diseases (i.e., the "old genetics"). These are rare diseases for the most part; so rare that we refer patients to genetic specialists. But the HGP is changing all that. Most of the single gene disorders and their genes have been identified. Attention has now turned to the complex or multifactorial diseases, i.e., diseases that involve multiple genes that interact with each other and the environment to produce disease (the "new genetics"). These diseases are not rare; they are the common diseases we see everyday in our clinical practices, such as the glaucomas, diabetic retinopathy, age-related macular degeneration, hypertension and atherosclerosis.

Paradigm Shifts

The HGP has started to increase and broaden the importance of genetics and genomics in all of health care. In fact, genetics has been called "the central basic science of medicine at the beginning of the 21st century."[1] Therefore, we are at the beginning of a major paradigm shift in optometry, medicine, and biology. This shift involves major changes in the way we will think about health and disease (see Table 1). These changes include a change from studying monogenic diseases (the "old genetics") to studying multigenic/multifactorial diseases (the "new genetics"), and a change from an emphasis on phenotype (observable traits) to an emphasis on genotype (the genetic constitution of the individual). They also include a change from an emphasis on treatment to an emphasis on prevention. This will occur as we identify individuals at risk for disease before they become symptomatic. Another change will be from genomics to proteomics. Since the Human Genome Project has finished sequencing the whole genome, we have moved into a postgenomics era where attention will now turn to proteomics to understand the structure and function of the gene products, the proteins. Thus, there will also be a change from studying genes in isolation to studying networks of genes involved in normal cellular processes and disease conditions. Hence, systems biology will take on new prominence.

These paradigm shifts are leading us as a profession into an era of molecular optometry. Our clinical practice will be starting a fundamental, revolutionary transformation. This transformation will change the way optometrists understand, classify, diagnose, and treat diseases. The integration of genomics into health care will create increasing pressure on all health-care providers to understand genetics and genomics and to learn new skills. We will need to begin looking at our patients through a "genetic lens," which involves incorporating genetic thinking and principles into our everyday practice.[2]

Table 1 — Paradigm Shifts

From:	To:
Monogenic disorders	Multifactorial disorders
Phenotype	Genotype
Treatment	Prevention
Genomics	Proteomics
Genes	Networks of genes

Dr. Wormington is associate professor of biophysics and optometry at the Pennsylvania College of Optometry. He is staff biophysicist of PCO's Light & Laser Institute and is a member and former chair of the AOA's New Technologies Committee.

Improved Understanding of Pathogenesis and Pathophysiology

As new genes are discovered, the mutations that can cause disease or make an individual more susceptible to disease will be found. This will lead to research into how the mutations and the altered protein products actually lead to disease. Then we will start to understand disease processes at the molecular level. As an example, three different genes have been found that can lead to the development of primary open-angle glaucoma (POAG). Myocilin (MYOC/TIGR – GLC1A) accounts for many cases of juvenile-onset open-angle glaucoma and about 3-4% of cases of POAG[3]; optineurin (OPTN) accounts for about 17% of the normal-tension type of POAG[4]; and the gene for cytochrome P4501B1 (CYP1B1 – GLC3A) is mutated in primary congenital glaucoma.[5] There are 9 other glaucoma genes that have been identified, and at least 22 loci have been located although the genes at these loci have not been cloned yet. The altered protein products of the cloned genes are being intensively studied to figure out why they increase the likelihood of developing glaucoma. This will increase our understanding of the pathogenesis of the glaucomas.

Improved Classification of Diseases

The Human Genome Project and advances in genomics are improving the ability to classify diseases. Most current classifications are based on phenotypes (e.g., clinical descriptions of the diseases), but this is beginning to be replaced by a genotypic classification scheme based on genetic causes and influences. One example is the reclassification of forms of retinitis pigmentosa (RP). There are autosomal dominant, autosomal recessive, X-linked and mitochondrial forms of RP due to mutations on different genes spread out over at least 10 different chromosomes.[6] This means that RP is really a group of diseases with widely different causes but similar clinical manifestations. Another example would be reclassification of corneal dystrophies due to the identification of disease-causing genes.[7,8] This genotypic reclassification will lead to the discovery and development of new drugs and drug targets.

Improved Diagnostic Testing

Currently there are genetic tests for over 1000 diseases with the tests being available from over 500 commercial labs.[9] The advent of microarrays (e.g., DNA chips, RNA chips, and protein chips) and lab-on-a chip microfluidics has the potential for revolutionizing diagnostic testing. It could lead to point-of-care testing in our offices. Three tests have recently become available for ocular diseases: the OcuGene test from InSite Vision[10], a microarray test for Leber congenital amaurosis[11] from Asper Biotech, and a microarray test for Stargardt disease[12] from Asper Biotech.[13] Many other tests are available from both commercial labs and research centers. In the near future, the number of genetic tests for ocular disease will rapidly increase.

Improved Management/ Treatment

Management of patients with monogenic and multifactorial ocular diseases will improve as the causative and susceptibility genes are found. The level of risk can be more accurately assessed, and the timing of follow-up visits can be determined. Any lifestyle changes that would reduce risk can be recognized, and new drug targets can be found. In general, treatment options will lag behind diagnostic options. However, an antisense drug for treating cytomegalovirus (CMV) retinitis was approved by the FDA in 1998.[14] Eventually gene therapy for some ocular diseases will become feasible. Successful gene therapy has been reported in a canine model of Leber congenital amaurosis.[15] Currently there are two phase I human clinical trials using viral vector-mediated delivery of the gene for pigment epithelium-derived factor, an anti-angiogenic factor, to treat wet age-related macular degeneration patients.[16-18]

Pharmacogenetics

When a drug is given to a patient, sometimes it works, sometimes it doesn't work, and sometimes it causes an adverse event. At least some of this variability is due to genetic differences among patients. For example, DNA variations in the genes responsible for drug metabolism can affect a patient's responses to drugs. Pharmacogenetics is the discipline that covers these kinds of variations.[19] In the future, pharmacogenetic advances will result in better and safer drugs, better methods of determining appropriate drug dosages, and "personalized" medicine.[20]

Ethical, Legal, and Social Implications

The advances in genetics and genomics have led to a number of ethical, legal, and social issues. Some of these issues are informed consent for

Table 2 — Possible New Roles for Optometrists in Genetics

- Managing patients' concerns and expectations
- Taking an efficient/useful family history
- Identifying genetic conditions
- Assessing/managing risk
- Screening
- Testing
- Recognizing ethical, legal, and social issues raised by genetic diagnosis
- Providing and coordinating long-term care
- Gatekeeping to specialist care
- Protecting patients' confidentiality and privacy of genetic information
- Maintaining up-to-date knowledge on new genetic technologies and advances
- Providing basic genetic information to patients and families to enhance understanding and informed decision-making

genetic testing, privacy and confidentiality, possible discrimination in insurance or employment, stigmatization, psychological impact, reproductive issues, fairness in access to genomic technologies, and conceptual and philosophical implications. These issues were anticipated by the Human Genome Project, which devoted 3-5% of its budget to the exploration of ethical, legal, and social concerns.[21]

Changing Roles of Optometrists

The genomics revolution is leading to a change in the roles played by optometrists. Some genetics professionals define the role of primary care providers as primarily one of referral.[22-23] On the other hand, some genetics professionals advocate a more active role for primary care providers.[24-26] Leaders of the profession of optometry should begin to define the new roles for optometrists in consultation with genetics professionals. The experiences of other professions in role-definition would be useful. In particular, physicians, nurses, and physician assistants have worked on defining their new roles and on the development of educational strategies for student and postgraduate clinicians. We should take advantage of their prior work and use it to shape our own roles. Some of the possible new roles for optometrists are listed in Table 2. Some build on existing roles and some of them are new roles.

Necessity for Educational Change

The exponential growth of knowledge about human genetics and its powerful implications for understanding, classifying, diagnosing, and treating disease demands the transformation of optometric education.[27] We need to refocus optometric education so that clinicians view their work through a new genetic lens. We need to learn to think differently and to make the paradigm shifts needed. A number of factors are precipitating the need for this kind of educational change:

1. Virtually all diseases have a genetic component and everyone has about 5-50 significant genetic flaws.[28]
2. There is an exponential rise in genetic knowledge.
3. There are new diagnostic, prognostic, and treatment options for visual system diseases.
4. There is a growing demand for genetic information and services by patients.
5. There are not enough genetics specialists to handle the increase in demand for genetic services.[29]
6. There is direct marketing of genetic tests to health care professionals and to patients.
7. Ophthalmic journals are publishing more and more articles on ocular genetics and the discovery of new ocular disease genes.

Educational Implications

Optometry schools and medical schools have been slow in recognizing and appreciating the significant implications of genomics and molecular genetics for professional practice. There are significant infrastructural problems. For example, there are not enough faculty and there is not enough time in an already crowded curriculum to incorporate the new science. There is a need to teach the new material at various levels: molecular, cellular, tissue, organ, epidemiologic, clinical, and ethical. In fact in 1999, Daniel Federman, the Dean for Medical Education at Harvard Medical School, addressed the need for curricular reform in medical schools in response to the rapid advances in genetics.[30] He discussed the impediments to change as well as a proposal of a new approach to learning and teaching.

In the last five years there has been a concerted call for action in the areas of educational change in both medicine and nursing.[31-34] These professions have produced a number of efforts to initiate this change in both the United States and in England.[35-39] We should learn from these efforts and use them as starting points for our own responses.

ASCO, AAO, and AOA

The implications for optometric education are broad and far reaching. At the level of the major professional organizations, there is a need for a response from the Association for Schools and Colleges of Optometry (ASCO), the American Academy of Optometry (AAO), and the American Optometric Association (AOA). Table 3 lists a few of the tasks that these organizations could address.

Faculty in the **schools and colleges of optometry should be surveyed** to determine how much genetics content is included in existing courses. The gaps in current genetics content can also be assessed. In addition, the current level of faculty training and the attitudes of faculty (e.g., with respect to the need for curricular change) might also be evaluated. An example of this type of response can be found in the nursing profession.[40]

It might be useful to **form an expert panel on genetics and optometry**. Genetics professionals and faculty from other professions could help a group of optometric faculty and leaders explore the implications of the genomics revolution for optometric education and clinical practice. The experience of educators and leaders from other professions that are a little further along in the process could be very valuable.

A **curriculum planning workshop should be organized** by ASCO involving faculty from all of the schools and colleges of optometry. This workshop could work on developing recommendations for increasing genetics content in optometric curricula. It could also work on drafting core competencies in genetics for optometric students. Evaluation

Table 3 — Suggested ASCO/AAO/AAO Tasks

- Survey the schools and colleges of optometry
- Form expert panel on genetics and optometry
- Organize a curriculum planning workshop
- Provide a summer genetics course for optometric faculty
- Design curriculum for continuing education in genetics
- Develop and implement guidelines for referral to genetic specialists
- Stimulate and foster development of optometric research in the area of genetics
- Develop patient education materials
- Become members of the National Coalition for Health Professional Education in Genetics

Table 4 Implications/Tasks for Schools and Colleges of Optometry

- Develop core curriculum guidelines for genetics
- Integrate core genetics knowledge, skills, and attitudes into the whole curriculum
- Develop the faculty
- Teach students how to access and evaluate new genetic information
- Consider problem-based learning to enhance integration and draw out implications
- Send key faculty for further training

Table 5 — Resources for Genetic Education

- Core Competencies in Genetics Essential for All Health-Care Professionals[43] (National Coalition for Health Care Professional Education in Genetics)
- Clinical Objectives in Medical Genetics for Undergraduate Medical Students[44] (Association of Professors of Human and Medical Genetics)
- Medical School Curriculum in Genetics Report[45] (American Society of Human Genetics Information and Education Committee)
- Teaching Medical Genetics to Undergraduate Medical Students [46] (British Society of Human Genetics)
- Recommended Core Educational Guidelines for Family Practice Residents[47] (American Academy of Family Physicians)
- Physician Assistant Core Curriculum in Medical Genetics[48]

strategies to assess the effectiveness of programs could also be developed.

One possible resource for faculty would be **a summer course on genetics**. This could be used to teach basic and clinical genetics content and skills to faculty from the various schools. It could also provide genetics curriculum resources for the faculty. One possible model is the Genetics Summer Institute developed for nursing faculty.[41]

Other possible tasks for ASCO, AAO, or AOA would be to **design a curriculum for continuing education in genetics**, to **develop and implement guidelines for referral to genetic specialists**, to **stimulate and foster development of optometric research in the area of genetics and genomics**, and to **develop patient education materials that could be supplied to clinicians**. One important task for the profession of optometry is to **become a participating member of the National Coalition for Health Professional Education in Genetics.**[42] The American Academy of Optometry and the American Optometric Association are in the process of becoming members.

Optometry Schools and Colleges

Table 4 lists a number of suggested tasks for the schools and colleges of optometry. For example, the **schools and colleges should develop core curriculum guidelines for genetics**. These could include family history taking, pedigree drawing, risk communication, and shared decision-making. They should also **work on integrating core genetics knowledge, skills, and attitudes into the whole curriculum**. It is not enough to add a genetics course or expand a current course in genetics; the genomics revolution needs to permeate essentially all of the courses and clinical experiences of the students. A wide range of subject matter should be covered, including scientific, clinical, ethical, legal, and social aspects.

Recently a number of professional groups have developed **guidelines for genetic education**. One excellent resource is the set of "**Core Competencies in Genetics Essential for All Health-Care Professionals**" developed by the National Coalition for Health Care Professional Education in Genetics (NCHPEG).[43] This document covers the knowledge, skills, and attitudes that can be used to guide the integration of genetics into optometric curricula. NCHPEG was formed in 1996 by the American Medical Association, the American Nurses Association, and the National Human Genome Research Institute of the National Institutes of Health. It now consists of over 120 health care professional organizations. The goals of NCHPEG are to integrate genetics content into the knowledge base of student and graduate health professionals and to develop educational tools and information resources to support that integration.

Other resources are the Clinical Objectives in Medical Genetics for Undergraduate Medical Students published by the Association of Professors of Human and Medical Genetics,[44] the Medical School Curriculum in Genetics report by the American Society of Human Genetics Information and Education Committee,[45] the genetic core curriculum in the report on Teaching Medical Genetics to Undergraduate Medical Students from the British Society of Human Genetics,[46] the Recommended Core Educational Guidelines for Family Practice Residents published by the American Academy of Family Physicians,[47] and the Physician Assistant Core Curriculum in Medical Genetics.[48]

Faculty need to be taught and developed as well. Faculty need to become knowledgeable about genetics, genomics, and their clinical implications. Support should be offered to faculty on incorporating genetics into their courses. Faculty should be provided with the NCHPEG core competencies and any optometry-specific core competencies that are developed.

Because of the rapidly changing knowledge base in genetics, **students will need to be taught how to access new genetic information and how to apply it to clinical care**. This would include the development of critical thinking skills, Internet searching skills, and the ability to evaluate sources of information for accuracy and validity. These kinds of skills can be developed effectively in problem-based, small-group courses. As a part

of the new curriculum at the Pennsylvania College of Optometry, students are involved in a problem-based series of courses every semester for the first two and a half years of the curriculum. Courses involve groups of eight students and a faculty facilitator. Besides being enthusiastically received by students, this kind of course enhances the integration of the basic medical sciences in the context of specific clinical cases. Genetics cases can be spread throughout these courses. This kind of approach also allows students to grapple with the ethical, legal, and social issues related to genetics cases.

Key faculty at the various schools should be sent for further training. One excellent resource for this kind of training is the Annual Short Course in Medical and Experimental Mammalian Genetics at The Jackson Laboratory in Maine.[49] This is a two-week course sponsored by The Jackson Laboratory and Johns Hopkins University. It is an efficient way to educate faculty on basic and clinical knowledge and new developments in the field of medical genetics.

Continuing Education

Many new opportunities for continuing education (CE) of optometrists need to be created. The changing role of genetics in eye care will require that practicing optometrists acquire new knowledge, skills, and attitudes. CE courses can be used to help optometrists develop a basic knowledge and overview of genetics and genomics, to learn the role of genetics in common ocular disorders, and to identify genetic resources for patient care. Clinicians will also need CE to know how to respond wisely to requests from their patients for genetic testing, to understand when and to whom to refer for complex testing and counseling, to enhance their history-taking skills, and to provide basic genetic counseling. New courses should be offered by the AOA, AAO, state associations, and the schools. Some of these could involve one- or two-day intensive courses in addition to courses at meetings. The Internet and distance learning should also be explored. New learning-support materials could also be generated.

National Board of Examiners in Optometry (NBEO) and Association of Regulatory Boards of Optometry (ARBO)

The NBEO should incorporate more genetics into their testing and should ensure broader coverage of genetics/genomics topics. The current number and type of questions on genetics and genomics should be assessed, and then new questions should be written. A change by the NBEO will help drive changes in the curricula at the various schools, just as it did when the number of questions in the basic medical sciences was increased significantly. Thus, the NBEO can play a catalytic role in the needed changes.

In a similar fashion, the state boards of optometry have a role in ensuring that optimal health care is delivered to the populations they serve. Through ARBO they should stay abreast of new developments and should consider the implications as new science opens new opportunities for rendering better care.

Optometric Education in the "Postgenomic Era"

Molecular genetics will be a powerful driving force in changing the way that optometry and medicine are practiced. These changes will place major demands on the optometric educational system. This will include training of optometry students, residents, and practicing clinicians. All students and practicing clinicians will need an understanding of the basic principles and concepts of genetics. This will include an awareness of new concepts like genomics, transcriptomics, proteomics, and pharmacogenomics/pharmacogenetics. However, the educational challenge is not just about updating optometrists concerning new advances. The explosion of information is more than most individuals can comprehend. What is especially important is how to access this new information and apply it to patient care. This will require a new educational paradigm that starts in optometry school and extends throughout a clinician's lifetime.[50]

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Genetics Education

In his June 9, 2003 Commencement Address at the School of Optometry at Inter-American University, Alden N. Haffner, O.D., Ph.D., president of the SUNY State College of Optometry, said:

"The revolution in human genetics offers enormous promise better to understand normal conditions, abnormalities and the human development cycle. Moreover, we will better comprehend disease processes and how and why the human being sustains the status of health. Indeed, genetics education, already a part of the optometric curriculum, will be expanded and, in time, receive more emphasis and more prominence."

Genetic Counseling Revisited

Jerry Rapp, Ph.D.

Over seven years ago, I published a letter urging organized optometry to broaden its scope of practice to include genetic counseling relating to hereditary ocular disease.[1] Despite some attempts by the author to promote this idea at both his own institution and outside, there has apparently been very little interest in pursuing this concept, something which the author finds baffling. At that time the human genome was in the process of being rapidly unraveled. At the present time, virtually the entire human genome sequence has been delineated.

An initial article[2] and editorial[3] that appeared in the **The New England Journal of Medicine** (which began a series) concerning the many facets and repercussions of an emerging "genomic medicine" has prompted the author to once again try and push the point of view that optometry needs to identify with genetics in a clinical setting much more than is presently the case or it risks becoming, at least partially, obsolete. Genetic counseling represents an excellent opportunity to do so.

A panel of experts should be assembled to discuss the educational underpinnings such an endeavor would require. There are two major educational components that would have to be implemented in order to institute such a program. Firstly, students at the colleges of optometry would need a solid and current knowledge base in the basic principles of molecular biology and genetics and the application of these principles to ocular genetic disease. This didactic component already exists to some extent at the author's school and, presumably, at other schools as well. However, with the ever-increasing knowledge base in this area, more hours in the curriculum and greater resources need to be devoted to this topic. Secondly, these principles have to be applied in a clinical setting. This could be achieved on two levels. A basic appreciation of genetic counseling as it applies to ocular disease could be presented to students as part of their professional school clinical training. Those who wanted to become more proficient could subsequently elect to do a residency in a program devoted to genetic counseling related to eye disease. The aforementioned clinical instruction would, of course, necessitate setting up new, innovative clinical programs and hiring appropriate personnel.

To illustrate the utilitarian value of genetic counseling as it relates to ocular disease, let us just look briefly and simply at the situation regarding rhodopsin mutations that result in autosomal dominant retinitis pigmentosa (ADRP). The amino acid sequence of rhodopsin, its linkage to retinal, its 3-dimensional structure and its role in visual excitation have been thoroughly delineated. Currently, well over 100 missense mutations in rhodopsin resulting in ADRP have been characterized. More importantly and very interestingly, significant progress has been made in relating functional visual deficits in ADRP with the specific rhodopsin mutation involved. So, for example, in a family with a LYS-296-GLU mutation (meaning glutamate replacing lysine at position 296, the binding site on opsin for retinal; meaning further that any rhodopsin thus expressed cannot bind retinal and cannot establish a critical salt bridge necessary for stabilizing rhodopsin's tertiary structure), there was little visual function after age 30 in most members. Just think of the potential benefits of genetic counseling in such a family with regard to, say, career planning. And, as already mentioned[1], this is something optometrists could easily do, assuming a well-designed didactic and clinical educational program was available. Realize, too, that this is just one example of a wealth of information that is emerging concerning the molecular mechanisms of a variety of ocular genetic disorders.

It is late, but still not too late, for optometry to incorporate genetic counseling into its panoply of practice. As already mentioned in the author's previous letter[1], the investment would be minimal compared to the fruits of expanded scope of service and consequent enhancement of patient care.

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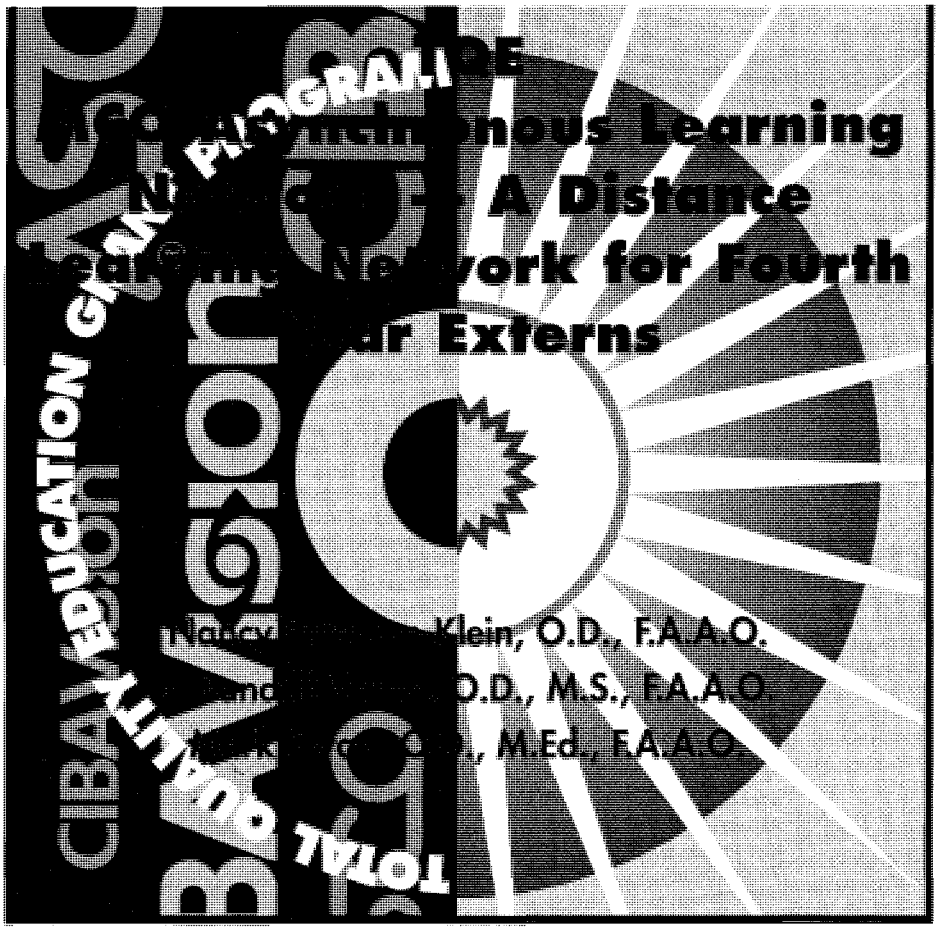

Asynchronous Learning: A Distance Learning Network for Fourth Year Externs

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Abstract

Problem: Fourth year clinical externships serve to bridge the gap between student and professional life. More than 70% of Michigan College of Optometry (MCO) externs are off campus their entire fourth year. They are isolated and separated from the support system previously provided through faculty and classmate interaction. The high volume of patients required to hone clinical skills and management strategies leaves little time to reflect on experiences and make connections to prior learning. In addition, as future independent practitioners, they must learn to utilize technologies to access support systems to meet the challenges of the developing profession.

Methods: The MCO Asynchronous Learning Network (ALN) was launched to respond to the unique challenges of a widely distributed external educational program. Using the WebCT course management software, an on-line course was established for all on and off campus faculty and externs. E-mail, discussions, event calendar, and links to useful learning resources were provided. Training in the use of WebCT occurred on campus prior to launching the ALN. Externs were linked to the course through web browsers at 23 sites. Minimum participation requirements for the 34 externs included regular postings to the discussion area, completion of a self-assessment survey, and completion of patient assessment quizzes. WebCT provided tracking information to quantify participant activity. There were 306 required postings by externs during the first rotation. Communications continued to accumulate in various forms, including self-assessment and curriculum assessment survey responses, quiz submissions, case discussions and private e-mails. Students used the ALN to state their goals, reflect on their experiences, and assess their own progress. Extern responses to this on-line course were very positive.

Conclusion: The ALN increased communication and interaction. The ability to monitor and frequently interact with the educational experience of the fourth year clinical program provided qualitative assessment beyond the limited information available through a traditional patient encounter log. The academic community established over the prior three years was maintained and enhanced through the utilization of on-line course tools.

Key Words: Asynchronous, extern, assessment, WebCT communication tools

Introduction

As in most colleges of optometry, the fourth year clinical externships serve to bridge the gap between highly structured and supported student educational experiences and independent professional life. Since high volumes of patients are needed to develop realistic clinical experiences, most fourth year students are rotated to busy off-campus clinics the entire fourth year or a significant part of the fourth year. More than 70% of Michigan College of Optometry (MCO) externs are off-campus their entire fourth year and are distributed among 23 different clinical sites located throughout the United States. As students enter the fourth year externship program, they are abruptly isolated from the campus support system previously provided through faculty and classmate interaction and on-site resources. Although students gain invaluable clinical experience while off-campus, simply having many clinical experiences does not ensure an effective transfer of knowledge and skills. During these externship experiences students may not have the intrinsic skills, motivation, or time available to make connections to prior educational and clinical experiences; hence, learning opportunities are often missed.

There is a great burden on the volunteer externship faculty who are similarly isolated from the central educational system. Also some externship sites (i.e., VAMC's, surgical centers, etc.) provide narrowly focused clinical experiences and may not provide the opportunity to supplement the student's primary care skills (i.e., CL fitting, third party billing, etc.). Administrative information and feedback cannot be provided in a timely manner that often promotes decision making on purely subjective or anecdotal information. Such a widely distributed fourth year experience creates difficulty in completing outcomes assessment to ascertain whether the fourth year program is successful in adding to the mission, goals and objectives of the overall educational program.

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A Web-based fourth year course was designed to improve communication between campus faculty and externship students, externship faculty and administration of the college. It was designed to provide the opportunity for input to and feedback from the externship educational process. The course enhanced the current externship clinical experience and modeled the use of technologies and strategies to access support systems in order to meet the challenges of the expanding clinical knowledge base and professional scope of optometric care. In addition, the on-line community created by this project provided a continuation of the academic and administrative infrastructure typically available at the central campus. The development of the curriculum and methods was supported in part by a Ciba Vision/ASCO TQE Grant, by the Center for Teaching, Learning and Faculty Development at Ferris State University, and by funds from the Michigan College of Optometry.

Objectives of MCO Asynchronous Learning Network

The MCO Asynchronous Learning Network was launched to better meet the unique challenges of a widely distributed external educational program. An Asynchronous Learning Network (ALN) is an electronic environment in which the student interacts with other student learners and the instructor in a manner that is not time or place dependent. In this environment, the instructor provides leadership, identifies and uses appropriate course tools and manages this process for learning. The student learner uses the software environment to collaborate with other student learners, Web resources and faculty experts to internalize the knowledge.[1]

The objectives of the MCO Asynchronous Learning Network course were to:

1. Improve communication among members of the principal groups involved with the externship program (students, on-campus faculty, off-campus faculty and residents);
2. Improve familiarity with electronic communications and their use for engaging in collaborative problem solving strategies and making connections with prior learning;
3. Increase student preparedness to function as members of health care teams through the Web, as well as in face-to-face settings;
4. Increase diversity of patient experience through sharing cases on the Web;
5. Provide timely feedback to the program to enable adjustment of curriculum content and teaching methods;
6. Increase familiarity with Web based searches; and
7. Provide ease and timeliness of dispersing and receiving administrative information and provide outcome assessment tools

Strategies of Effective On-line Teaching

Prior to initiating an on-line course, it is important to review strategies for effective teaching.[2] Just as in the traditional face-to-face classroom environment, effective instruction on-line does not occur without attention to good teaching practices. **Frequent student and faculty contact** motivates students to be engaged in an on-line discussion course. A continuing connection with faculty and classmates can help the isolated off-campus student maintain academic activity and support the transition between the scheduled environment of academia and the daily patient care responsibilities of professional independence. A student's intellectual commitment is further enhanced when the student knows a few faculty members well. Familiarity allows students to approach faculty to talk about their values, concerns, challenges, and strategies to resolve dilemmas. The fourth year is an ideal time in the curriculum to have these discussions.

Another good teaching practice is to **encourage collaboration** among students. Collaborative work enhances learning. Improved thinking and a deeper understanding can occur by sharing one's own ideas and responding to other reactions.[3] Active learning occurs when the students talk about what they are learning, write about it, tie it into past learning and experience and apply it in their daily clinical encounters. By questioning each other, and by constructively critiquing each other's work, we reinforce and advance the group's and each individual's understanding of underlying concepts. An on-line course can utilize all these components through guided participation in discussion activities.

A good teaching practice whether on-line or face-to-face, involves **providing prompt feedback** to the student. Fourth year students especially need to learn how to assess themselves as they transition to more independence within the health care arena. The ability to provide instantly graded self-assessment quizzes via the Web allows students to review and check their understanding of prior facts, concepts, diagnoses and managements.

Good teaching practice emphasizes **time on task**. "Time on task plus energy equals learning."[2] Fourth year students need to allocate sufficient amounts of time to study, so they embrace the need for life-long learning, and develop techniques for life-long learning to ensure their continued high performance in the future.

Methods

Using the WebCT course management software,[4] a 12-month ALN course was established for all on-and off-campus faculty and fourth year students. The course mail-tool, discussion tool, quiz and survey tool, event calendar, and links to useful learning resources were used to provide enhancement of the fourth year educational experience. (Table 1)

Training in the use of these WebCT tools occurred on campus prior to launching the ALN course. In addition to the experiences students had in using WebCT at MCO in prior courses, specific hands-on activities were provided to the third year students in preparation for the ALN course. For example, students learned how to compose, view, reply and manage discussion postings, and how that differs from personal e-mail. Training and practice in how to attach, detach, and view document and image files within the course mail or discussion tools was provided in preparation for case presentations and discussions that would occur in the course. On-line interaction concepts such as netiquette and observing the privacy of patient or student-related information were also included.

A syllabus was provided in the ALN course to outline the assignments with required time frames, and directions were given to remind stu-

Table 1
WebCT Tools and Examples of Use

WebCT Tool	Description	Examples of Use
Mail Tool	Integrated private e-mail tool for electronic messaging between specified parties. Enrollment into the course site automatically creates a private mailbox for that individual.	1. Provides confidential messaging within the course site among and between students and faculty. 2. Avoids need to request and maintain a list of external e-mail addresses. 3. Electronic spreadsheet patient log forms were sent in to Director of External Rotations secretary via attachment to course mail; secretary detaches and compiles all sheets into a master record.
Discussion Tool	Open forum for one-to-many electronic messaging; documents and organizes the postings according to the path (thread) in which discussion proceeds. Allows for attachments of document and image files, which is especially helpful for on-line case presentation and discussion.	1. Case presentations were undertaken; Shared experiences offered opportunities for learning. 2. Externs stated their goals and objectives for each rotation experience. 3. Externs reflected on their goals and summarized their learning experience at the end of each rotation. 4. Housing information about the site was posted for the benefit of externs to follow. 5. Current Issues discussed such as how recent research study will be incorporated into practice patterns. 6. Announcements were made without having to maintain a list of external e-mail or regular mail addresses.
Quiz Tool	Provides delivery of on-line quizzes using a variety of question formats including multiple choice, short answer, calculated, and paragraph. Color still or video images can be incorporated into the question stem. Automatic compilation of class performance statistics, and individual item statistics. Item statistics can be pooled over successive administrations of the quiz.	1. Multiple-choice quizzes were delivered covering different general areas of optometry. 2. Questions on clinical cases had several diagnostic and treatment questions. 3. Once graded and viewed by the student, there is immediate feedback with each answer chosen as to why it is correct or why it is incorrect. 4. Students see where their scores are in comparison to the group, but are not currently made part of the course grade. 5. Multiple attempts allow student to assess feedback, review, and repeat the quiz for improved score.
Survey Tool	Features similar to Quiz Tool but provides for anonymous submission of responses. Documents which students participated in the survey, but identity of the responses is masked from the instructor.	1. A self-assessment survey was conducted in order to have students reflect on their current knowledgebase and skills, specifically asking them to rate their preparedness in several general areas of patient care as they entered their first externship. 2. It was recommended that students develop active strategies and set goals to address areas in which they felt weak. 3. Results were compiled and posted to allow students to compare themselves to the overall class results. 4. Provided feedback to college faculty and administration as to how well the prior curriculum and experience prepared them to succeed in rotations.

WebCT Tool	Description	Examples of Use
URL Tool	Links to other internet resources can be set up within the course site using the Universal Resource Locator (URL) address.	1 Centralizes many resource links for the students including searchable databases, patient and practitioner eye and vision care information, state and national examination and licensing information, residency information and applications.
Student Tracking Tool	Maintains record of first and last access date/time, number of hits, number of discussion items posted, and number of discussion items read.	1. Record, monitor and quantify individual course participation activity to assure meeting minimum stated requirements in syllabus. 2. Documents which course content pages were accessed by the student and when.
Page Tracking Tool	Maintains record of number of accesses for each content page, total time each was accessed and average time per access.	1. Analyze which pages are being used most often, and being found most relevant and useful.
Calendar Tool	Provides a mechanism to publicly post events and deadlines in a convenient calendar form. Students can use this feature as a personal organizer by making private postings, visible only to them, which are integrated with the public information. Calendar events can have a link attached to them to provide further related information within the course site or externally.	1. Basic course assignments and due dates were posted in the calendar as well as provided in simple text format within the course syllabus. 2. University and college academic calendar dates were incorporated. 3. NBEO administration dates were posted along with a URL link to the NBEO web site.

dents how to format and post cases and images within the discussions tool. Ready reference to administrative information was provided by a series of linked pages in the course site containing administrative policies, rotation schedules, immunization requirements, protocol for teleoptometric grand rounds, and the Extern Clinical Evaluation Forms. Students record and enter their patient care experiences in a standardized spreadsheet, which is then sent in as an attachment via the course mail tool. The spreadsheets are compiled for internal review as outcomes measures.

Externs were linked to the course through Web browsers at the 23 externship sites or through their own home computer. Minimum participation requirements for the 34 externs included regular postings to the discussion area, completion of clinical self-assessment surveys, completion of patient assessment quizzes, posting and discussion of cases in the electronic grand rounds, and participation in "clinical pearls" discussions. Externs posted reflections on what their goals were for the rotation, what they learned during the rotation and the challenges they encountered. The WebCT course management system provided page and student tracking information in order to verify and quantify participant activity. The participation requirements increased with each rotation. At this time there is no formal evaluation or assessment of the quality of the comments or postings. Appropriate terminology and content are modeled by the comments of residents and faculty.

Many resource links were provided from within the course site for easy access to information on residencies, state and national licensing examinations and requirements, as well as patient and practitioner vision and eye care information. A variety of search engine links were incorporated into a course page along with information on how to use them in "Finding Articles on Vision Science Topics" provided by our faculty librarian.

Results

After one year of existence, the MCO Asynchronous Learning Network course achieved all the objectives listed above. Spontaneous communications accumulated beyond that required as minimum participation in the course, including survey responses, announcements, case discussions and private e-mails. Students used the ALN to reflect on their experiences, state their goals, and assess their progress.

Initially, two instructors managed and facilitated the discussion activity with input from residents encour-

aged. The contributions of the residents soon became an integral part of the content as they took a very active role posting discussion topics, challenging diagnostic questions and generally encouraging the students to be involved and not to allow their fourth year to slip away without challenging themselves. The Resident's Case Forum was also developed, in which residents from affiliated sites posted and led discussion about cases they had encountered. Future resident participation in the ALN course will be strongly encouraged and written into the residency curriculum objectives.

Faculty members were able to connect and communicate with students without being bound to a common time and place. However, there was limited on-line participation by externship faculty. Their participation was not mandated as part of their duties. Annual or biannual WebCT hands-on training workshops for externship faculty are anticipated to help provide the confidence needed to participate as well as reinforce the mutual benefits of this form of communication with the college.

Discussion

Since 70% of MCO students are not on campus during the entire fourth year, one objective was to maintain the sense of community that was established during the prior three years. The volume of registered discussion postings indicates how easily most students incorporated these tools into their daily activities. The author's observations of the posting contents demonstrated typical exchanges and communication among friends and colleagues that are commonly witnessed in face-to-face campus interactions. In addition, many personal e-mail exchanges were made using the course mail tool, which provided a consistent electronic address, regardless of the many physical address changes that occur during the year. (Refer to Objectives 1 & 2)

On-line assessment in the form of quizzes provides students with instant feedback on their performance. Using the self-tests, students gauge their knowledge of clinical problems, helping to reinforce learning and retention. Some of the self-quizzes are designed to provide automatic feedback for each potential answer, correct and incorrect. Feedback informs the student why the correct answer is correct and why the incorrect answers are so, illustrating the necessity of knowing the underlying concepts. Students felt encouraged to use self-tests as a study tool. Allowing multiple attempts provided a means to learn from the first attempt, review and return for another try. (Refer to Objectives 2,3 and 5)

The objective of improved familiarity with on-line communication was met by providing four hours of active training in the use of all pertinent WebCT tools as well as how to post case studies, images and scanned reports. The relative ease with which students used the tools proved the value of the pre-training workshops. Furthermore, several students quickly exceeded the minimum participation requirements with routine comment postings, sharing additional cases, and queries of their classmates regarding management decisions of challenging cases. (Refer to Objectives 1 and 2)

The threaded discussions generated under the various topics illustrated to students how they can interact as members of health care teams through the Web, as well as in face-to-face settings. On-line threaded discussions require students to express and defend their opinions. This activity reinforces their problem solving skills by requiring them to articulate their reasoning and evidence. Since the responses are not real-time dependent, students have the opportunity to reflect, review, and research before posting their comments. Being exposed to many opinions prepares the students for life-long learning as they compare and contrast other opinions with what they already know, and come to some conclusion about the subject. (Refer to Objectives 3 and 6)

The posting and subsequent discussion of over a hundred case studies provided an increase in patient diversity. Case content reminded the students to review and connect their prior learning in areas of patient care not typically seen at their current rotation site. Some students discussed the difficulty they experienced in adapting to a "pure "SOAP" format" of recording data at their off-campus site, compared to the fill-in-the-blank type record used in the on-campus clinics. These comments are an example of how the ALN course was used to provide timely feedback to on-campus faculty so that they can adjust course content to expose students to the blank page method of data collection prior to the start of the student's fourth year. (Refer to Objectives 4 and 5)

A small group-facilitated discussion format used during Rotation 3 requires students to use Web-based searches to support or refute the management decision as presented in the case study. This provides another teaching opportunity for those affiliated residencies that have teaching as one of the objectives in their program. Three faculty and residents currently facilitate six groups of five students each. Some students are still hesitant to use Web-based searches to better understand the problems or questions presented. Utilization of on-line resources and the assessment of their validity is an identified area for improvement within the MCO curriculum.[5,6] (Refer to Objectives 2, 3 and 6)

Administrative communication was greatly enhanced through the use of the WebCT tools. The Discussion tool was organized into several topic areas: Case Discussions, Current Issues (to discuss current events such as legislative affairs, recently published study results, etc.), Housing Information (to post housing options, costs, commute times, etc. for the benefit of the externs who would follow at each site), and Announcements (to post informational items that did not require interactive discussion). Calendar and announcement functions as well as a series of linked pages called "Policies and Procedures" simplified the process of communicating critical information with specific time lines. Appropriate continuing education programs that the students were welcome to attend were posted, and the coordination of plans for industry-supported trips for the students was facilitated. (Refer to Objective 7)

Accessibility of the course required continual monitoring and coordination with network managers at external sites. Our experience indicates an increase in the number of externs with personal Internet access. Externs without personal computers rely on Internet access at the site or log on through a nearby library. Some students indicated they preferred to go on-line while at home rather than from the clinical site's computers. They felt less rushed and better able to reflect on their responses.

In-depth discussions were limited given a group size of 34 students.

Table 2
Future Considerations

Establish a mechanism for recent graduates to participate.	1. Provides a continued contact with alumni. 2. Provides access to recent graduates and information fourth year students want regarding entering practice.
Establish mechanism for third year students to participate.	1. Fourth year students could provide a mentoring role for third years. 2. Third year students gain familiarity with the tools and see value ("buy-in"). 3. Would improve understanding of tool use while on campus where personal help is readily available.
Promote and obtain more faculty involvement.	1. Provides greater diversity of opinions. 2. Establishes more cooperation and coordination between on-campus and off-campus faculty.
Establish a database of cases.	1. Provides a "master" set of cases with which to evaluate and assess diagnostic and management knowledge and strategies of all students.
Further automate the submission of patient encounter data, and student evaluation data.	1. Reduce the student and administrative effort in keeping, submitting, receiving and processing patient encounter data. 2. Improve on-time receipt of student evaluation reports.

However, we felt it was very important to establish the virtual community with all the students together during their first and second rotation. During the third rotation, private discussion areas are set up for groups of five students, and each group has a faculty moderator. In this manner, we sought to generate more involved discussions and more individual participation. As an offshoot of this early ALN experience, MCO concurrently participated in a collaborative grant with Pacific University and SUNY to develop a virtual classroom for six fourth year students located at various sites utilizing an Evidence Based Medicine paradigm.[7] The early results from the collaborative study indicate small group discussions require more time on task by the fourth year student and faculty facilitators. But smaller groups are more productive, especially when strict guidelines are set, and when both quality and quantity of participation can be assessed and graded by the instructor.

Future Considerations

A listing of possible ways to utilize the ALN to further enhance the program is provided in Table 2.

Conclusions

The ALN increased communication and interaction and allowed less expressive externs an opportunity to compose and reflect on their responses without the time demands of face-to-face communication. Learning within the context of full-time patient care clearly has added value to what has been done in the classroom. The ability to monitor and frequently interact with the educational experience of the fourth year clinical program provided qualitative assessment information, in addition to that available from the traditional patient encounter log. The ALN provided a virtual location for off-campus externs and faculty to connect with the on-campus program to maintain and enhance the sense of academic community established over the prior three years.

Acknowledgments

We gratefully acknowledge the support of the Ciba Vision/ASCO Total Quality Education Grant Program (TQE), the Michigan College of Optometry, and the Center for Teaching, Learning and Faculty Development at Ferris State University. This information was presented as a poster at the American Academy of Optometry annual meeting, December 10, 2001, Philadelphia, PA.

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Rights and Responsibilities of Optometrists

How a new course in The Ohio State University College of Optometry's curriculum was conceived, designed, implemented, and evaluated

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Introduction

In the fall 2000 issue of *Optometric Education*, an Association of Schools and Colleges of Optometry (ASCO) report entitled "Attributes of Students Graduating from Schools and Colleges of Optometry" was published by a distinguished committee of optometric educators. In this document, the authors carefully evaluated both (a) the nature of the doctor of optometry as a health care provider as well as (b) the nature of the educational and profession environments in which these doctors practice. Their report concluded that the new optometry graduate must be professional and ethical, knowledgeable, and skillful. The report also charged the faculty at each ASCO institution with the responsibility "to develop curriculum, and to assess and verify that each graduate has demonstrated the attributes described (in their report)."[1]

At about the same time as this report was being developed, the faculty of The Ohio State University (OSU) College of Optometry was discussing the possibility of adding a new course to the curriculum of first year students that would include topics in professionalism and responsibilities of optometrists. According to notes made at that time, "such a course might influence the attitudes and points of view of our students during their academic careers and beyond." The proposed course would include instruction in the areas of professionalism and ethics, professional development and self-directed lifelong learning, introduction to community health, and interpersonal skills (see Table 1). This new course was ultimately approved by the Office of the Provost at OSU with the following title and course description:

Optometry 402: Rights and Responsibilities of Optometrists

(2 credit hours, Spring quarter, first year)

Evaluation of the role the following factors have on the provision of vision and eye care to the public: professionalism and ethics, professional development, community health factors, and interpersonal skills.

The author was selected to design and teach the inaugural course in the spring of 2000. It is appropriate to share the author's experiences, both positive and negative, with optometric colleagues after three years of teaching the course. For those in optometric education, perhaps some of the methods and topics in this new course will be applicable to their own teaching responsibilities. And for those in optometric practice, the author hopes this paper will show how one school has modified the curriculum to better prepare its students for success after graduation.

Course Design

This two-credit hour course was taught in the spring quarter of the first year, which, because Ohio State is on a quarter system, permitted 20 hours of actual class time. Optometry I students were also taking classes in optics of the eye, ocular anatomy, pharmacology, and pathology during this quarter. The course is part of a professional orientation track sequence, and is preceded in the OSU curriculum by Optometry 401, a survey of the profession course (i.e., development of optometry and optometric education, scope of optometric services, optometric organizations, sources of vision information, current vision research, etc), taught in the first (fall) quarter of the first year.

The first week's topics included explanation of the class syllabus (meeting time and place, instructor's office location and phone number, grading criteria, policy on academic misconduct, etc) and the course objective:

> *To prepare the first-year optometry student for success in future clinical courses, as well as in the independent clinical practice of optometry, by teaching the underlying decision-making skills behaviors, attitudes, values, and ethics needed for the delivery of high-quality patient care.*

In addition, during the first class session, each student was asked to identify attributes of a professional (or unprofessional) office. Some common professional behaviors identified by the class were knowledge, courtesy, good hygiene, good communication skills, and efficient management. Some common unprofessional behaviors identified by the class were dirty office, old equipment, poor hygiene, sloppy records, condescending attitude, and outdated information. These responses were then compared to the ten professional behaviors identified in a book by Kasar and Clark entitled *Developing Professional Behaviors*. Although the authors are occupational therapists, their insights are applicable to students and practitioners of health care professions at all levels[2,3]

Dr. Newcomb is a professor and previous director of clinics at The Ohio State University College of Optometry.

Figure 1
Example of an Ethical Dilemma in Optometric Practice

A nicely dressed parent brings her seven-year-old daughter to your office for a comprehensive eye examination because she failed the vision-screening test at her elementary school. Even though her best-corrected visual acuity is 20/20 in each eye, you note bruises around her eyes and a resolving subconjunctival hemorrhage in the right eye. You suspect these findings were caused by child abuse. The parent tells you her daughter fell off her bicycle, and the emergency room doctors told her there were no fractures. You know that parents must give you permission to provide health care services to their minor children; and also that all of your data must be kept confidential under the federal government's new HIPAA regulations. However, the Ohio State Board of Optometry requires its licensed optometrists to report any suspicion of child abuse. What would you do?

The second week's topic was clinical epidemiology, which is "the study of how and why diseases and other conditions are distributed within the population the way they are."[4] In these two class hours, students learn the difference between incidence and prevalence rates, the natural course of any disease process, and formulations for calculating relative and attributable risks. They then use these formulae to calculate the strengths of associations between various risk factors and common diseases.

The third week's topic was "Introduction to Ethics."[5] It included discussions on identifying an ethical dilemma and thinking through the dilemma to eventually arrive at an ethical decision. Sample case studies were used to illustrate some ethical problems in an optometric practice. During the fourth week of the course, two more hours of class time were spent discussing ethical decision-making by using more optometric case studies. An example of one such scenario is described in Figure 1.

During the fifth week of class, verbal and written communication skills are discussed.[a,b] Various personality types are explained (i.e., bolds, expressives, sympathetics, technicals) as well as various types of doctor-patient relationships (i.e., paternalistic, consumerist, mutuality, default). The students are given lists that indicate what doctors should do to show concern for their patients as well as some clinical keys to success for pediatric, adolescent, and geriatric patients. To help the students practice their verbal and written communication skills, they were required to interview a stranger and to then write a two-page essay on their experience (please see Appendix I for a copy of the class assignment), some of which would be read aloud to the entire class during the ninth week.

A mid-term examination was given during the first class hour of the sixth week. The second hour was devoted to lectures on good optometric record keeping[6] and how to prevent malpractice.[7] The author used his own personal experience in serving as an expert witness in an alleged optometric malpractice case, and discussed the four requisite elements that must be present to convict an optometrist of malpractice in court. Tips on how to avoid malpractice claims were also distributed to the class at this time.

Week seven's lecture topic was clinical decision making. This lecture included the six distinct steps of making a diagnosis,[8] as well as discussion of ten common errors of clinical decision making from the book entitled *Clinical Decision Making in Optometry* by Ettinger and Rouse.[9] Fictitious cases were presented to illustrate "real life" examples in optometric practice.

During the two hours of class time in the eighth week, the course varied in content each of the three years. In the first year this course was taught, the author invited OSU clinic chiefs into his class to discuss optometric specialties (contact lenses, pediatrics, binocular vision, low vision rehabilitation, ocular disease, etc). In the second year, he presented a general dis-

Table 1
Proposed Topics for a New OSU Course Entitled "Rights and Responsibilities of Optometrists"

1. Professionalism and ethics
   - a. honor code
   - b. optometry oath
   - c. involvement in professional and community organizations
   - d. test-taking, attendance, plagiarism, use of the internet
2. Professional development and self-directed life-long learning
   - a. resources (internet, journals, continuing education opportunities)
   - b. research
   - c. learning style inventory
   - d. problem solving and critical thinking
   - e. problem based learning
3. Introduction to community health
   - a. Role of optometry as primary care provider
   - b. Methods of epidemiological investigation
   - c. Roles of other professionals and other resources
   - d. Introduction to clinic
4. Interpersonal skills
   - a. Development of written and oral communication between clinician, staff, patient, and other professionals
   - b. Decision making and problem solving
   - c. The case history
   - d. Writing summary/referral letters
   - e. Diverse patient populations
   - f. Records

cussion of managed care, and how it affects the contemporary practice of optometry. During the eighth week of the third year, another OSU faculty member gave a guest lecture on the importance of volunteering time in various optometric organizations (AOA, AAO, VOSH, OSU Alumni Association, etc). All of these lectures were intended to broaden the perspective of first year students on their chosen profession.

The ninth week of the course was much anticipated! This was the time that selected class essays were shared with the entire class; and common themes on what differentiated good professional behaviors from bad professional behaviors were discovered. The instructor selected the 5-6 essays to be read aloud based upon their potential to stimulate interesting class discussions and "teachable moments."

The last two lecture hours of this course in the tenth week provided ample time for a discussion of the Association of Schools and Colleges of Optometry's (ASCO's) report on "Attributes of Students Graduating from Schools and Colleges of Optometry," followed by a white coat ceremony where each first year optometry student received his or her white clinic coat from a College administrator. Since the OSU College of Optometry is housed in an academic building named Fry Hall, a videotape of Dr. Glenn A. Fry was then shown to the students so they would know and appreciate his outstanding contributions to their alma mater and profession.

Student Evaluations of the Course

At The Ohio State University, all students are encouraged — but not required — to complete an anonymous "SEI - Student Evaluation of Instruction" questionaire at the conclusion of each didactic and clinical course.[c] These SEI forms contain numerical scores as well as written comments and are intended to provide constructive feedback, both positive and negative, to the course instructor. The instructors can then use this feedback to make improvements in their teaching content, style, assignments, class discussions, grading criteria, etc.

After the course was taught the first time, the students' feedback was mixed. They suggested more discussion on ethical behaviors, and less on optometric specialties and the administrative aspects of our internal teaching clinics. In addition, since the initial writing assignment required them to interview members of a targeted population in the Columbus community (i.e., African Americans, Asians, Native Americans, Middle Easterners, etc), they were very uncomfortable with approaching cultural strangers and asking them to answer the survey questions. The course was modified in the second year to address these three concerns.

After the course was taught the second time, the students' feedback was generally favorable. They asked for less emphasis on epidemiology and managed care; and did not feel the final examination adequately measured their knowledge of all the diverse topics covered in class. The course syllabus was essentially unchanged in the third year, but an open-book, take-home final, which required a thought-provoking essay on how to handle an ethical dilemma, was given instead of the traditional closed-book, two-hour, in-class final examination.

The student evaluations after the course was taught a third time were overwhelmingly positive. Their only major criticism involved the white coat ceremony on the final day of class. While most students did not make any comments, some felt the ceremony could have been more meaningful if the course instructor had called each student by name and provided a better-quality group photograph. Their suggestions will be incorporated into the white coat ceremony planned for the 2003-2004 academic year.

Summary

The concept of professionalism can be an abstract notion for some students. While the definition of a profession has been well described previously in this journal by Christensen,[10] perhaps Haffner offers the best definition of the word professionalism:

Professionalism is a demanding code of behavior practiced by its adherents, which requires their unstinting commitment to ever expanding excellence in learning and knowledge... . (It) involves an attitudinal ambiance, which differentiates...callings, which are entrepreneurial in their primary cast...Professionalism provides that quality of nobility to a discipline, which gives it its self-esteem, its self-restraint, and its self-realization."[11]

At The Ohio State University College of Optometry, the new course described above was recently added to the curriculum to enhance our students' understanding of professional behavior, including the rights and responsibilities of being an optometrist. The author hopes his experiences in teaching this course over the past three academic years will be helpful to colleagues in other schools and colleges of optometry.

Footnotes

[a]The Advanced Relationship Techniques (ART) of eye care by CIBA Vision, a Novartis Company, Duluth, Georgia, 1998.

[b]"Speaking Eye to Eye". The Acuvue Eye Health Advisor Program by VISTAKON, Division of Johnson & Johnson Vision Care Inc, Jacksonville, Florida, 2003.

[c] Contact the author for a copy of OSU's Student Evaluation of Instruction form.

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COMMENTARY

Why All Optometry Students Should Have Laptop Computers for Classroom and Clinic Use

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After several years of discussion, the Pacific University College of Optometry faculty voted to require laptops for all first year students entering in fall 2001. For the past three years, students have dutifully carried their computers to most classes and have found interesting uses for them ranging from downloading PowerPoint presentations and taking notes to surfing the Web when lectures became boring or exceeded their attention spans.

Since then, it has become apparent that computers are very powerful support tools that have the potential to revolutionize optometric education and practice. However, they do not fit very well into traditional hour-long lectures in which students are asked to passively absorb information for later memorization.

Each Pacific faculty member had his or her own reasons for supporting the laptop requirement, but, for many members, laptops were not mandated simply to solve existing problems. Instead the laptop requirement anticipates current and future changes in optometric education and practice.

Here are several premises that support a laptop requirement for all optometry students.

Premise 1. Several decades ago, optometry was a much more limited-scope profession with a relatively well-defined body of knowledge that could be mastered prior to graduation. This is no longer the case. Computers must be used in patient care to find information on an as-needed basis to supplement memorized facts.

An editorial in *Science* magazine[1] has suggested that in the old days there was a mountain of knowledge that had to be mastered and memorized prior to graduation with a medical degree. Now the body of knowledge in most of the health professions has grown too large to be memorized, so it is likened to a river or a stream from which information is extracted on an as-needed basis by use of a computer.

As an analogy, consider how companies manage their inventories. The old way involved huge warehouses full of parts that would be used to assemble the companies' products. Now companies maintain only a minimum inventory and obtain parts as needed from suppliers. Optometric knowledge is like inventory. It is most efficient to maintain only an inventory of frequently used facts in the brain and obtain additional information as needed using the computer.

This does not mean that optometry students no longer need to learn or memorize anything, nor does it mean that the frequency with which a student or doctor must access the computer to find information will stay constant as experience grows. Obviously, commonly used facts and skills must always be carried in the head and this body of knowledge will grow with experience. However, seldom used formulae (e.g., cross cylinder equations), complex biochemical reactions, and other details that can be quickly retrieved as needed by using the computer need not be memorized.

One of the functions of optometric education must be to teach students how to use laptop computers to quickly find and use information in classroom and clinic environments.

Premise 2. Becoming reliant on computers will change the ways in which optometrists learn and practice.

Those who are old enough will remember when hand calculators were first introduced into schools. Many argued that they would render students completely unable to perform even simple mathematical operations on their own and the downfall of America would surely follow. This has not happened, but there has been a shift in the way most of us deal with math. Instead of doing long division or multi-digit multiplication on paper or in our heads, we have reduced time, effort, and errors by letting a calculator do the work. Now we can devote more time to understanding mathematics and less time to rote operations.

As computers become more ubiquitous than hand calculators, they will do the same thing for optometric education and practice. They will free up our mental processing capacity to think and reason rather than memorize thousands of optometric details.

Laptop computers in the classroom will open the door for many changes in education, such as the development of classroom exams that ask students to demonstrate their use of computer-obtained knowledge to solve patient problems as opposed to simply recognizing isolated facts.

In practice, computers are already required for billing and office man-

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agement and are integral parts of many test devices. Soon they will enter the exam room and actively participate in making diagnosis and management decisions by providing essential information and making critical decisions.

Premise 3. Decisions about patient care will be augmented by advice from computers in the near future, and, in the somewhat more distant future, computers will actually make decisions with little or no human supervision. Students and faculty members need to use computers in decision making now so as to anticipate future advances in patient care.

Although the field of artificial intelligence (AI) in which computers make decisions using rules or logic provided by human programmers seems like science fiction to many, it is already being used in health care environments, including optometry.[2-4]

At its most basic level, diagnosis of a patient's problem involves a process in which signs, symptoms, and test results are matched in the doctor's brain with memorized patterns of signs and symptoms that are mentally associated with disease names. Some doctors remember more associations, some remember fewer, but this is how diagnoses are made.

Association matches can be stated in the form of If-Then rules or neural networks and can be coded into computer AI programs called Expert Systems (ESs). The ES programs can then examine patient data to develop diagnoses and recommend management plans using the same rules that a human doctor would use. For those who doubt that there is an application for this in optometry, look at the printout from the Humphrey Field Analyzer Stat Pac and ask how the program classifies the patient as normal, borderline, glaucoma suspect, or generalized depression.

Although using the computer to make diagnoses and treatment plans is intriguing, financial applications are also interesting. At Pacific, students are being taught to use laptops for patient data and billing entry, and soon these entries will be checked by an ES to increase the probability of third party reimbursement.

Where is all this leading? Star Trek provides an interesting prediction regarding the future of interactions between human health care providers and ES computers. In early episodes of the series, health care is provided by a human, Dr. Beverly Crusher, who is aided by various computers. In later versions, health care is provided by "The Doctor," a totally computer-generated hologram that uses AI (and human helpers) to treat the crew.

For those who are still not convinced that computers and AI will move from appointments and billing to patient care decisions, *Newsweek* magazine cites a George Washington University forecast poll predicting that ES software will compete with lawyers, physicians, and other professionals in the near future. How soon? The poll indicates that this will happen by 2008, just 2 years after our current first-year students graduate.[5]

Premise 4. Teaching does not always equal education. Often students do not learn very much from a lecture, even one loaded with PowerPoint slides. Using laptops in the classroom can enhance active learning opportunities and increase the probability that students will be able to use what they are learning for patient care.

For thousands of years, education has taken the form of one person lecturing to others. This process has several advantages and some major disadvantages. Perhaps its biggest advantages are that it is cost effective (i.e., one person can lecture to many at the same time), and it is an "ego trip" for good lecturers. Students also like the format because they can sit passively and allow knowledge to flow into (or through) their heads knowing that the professor's notes and PowerPoint slides have been safely downloaded into their laptops for later study.

However, we have learned that lectures-as-usual and a classroom full of students with laptops do not mix very well.

Lecture is a passive learning situation and students are not actively interacting with the information being delivered; therefore long-term retention is poor. In addition, typical lectures last from 55 minutes to two hours and in passive situations students have attention spans of about 20 minutes. After that, they go into audit mode, or find something else to do until the lecture period ends (e.g., they surf the Web, send notes to classmates, or just fantasize).[6]

For students in the classroom who have laptop computers connected to the Internet, there are many ways to actively enhance the learning process. McClain et. al have suggested numerous techniques that allow students to access information, to integrate and use what they have learned, and to practice patient management skills using simulations.[6] By inserting computer or internet-oriented activity breaks about every 20 minutes, a traditional lecturer can maintain some degree of student attention for 60, 90 or even 120 minutes.

Beyond modifying lecture-based delivery of information, access to a computer can facilitate learning outside the classroom. For example, at Pacific students can use several patient care simulation programs and other learning aids.[7]

Premise 5. The National Board of Examiners in Optometry will soon realize that the Part One Basic Science Examination should reduce emphasis on memorization of detail and increase emphasis on thinking skills.

Whenever a program is discussed in which first or second year optometry students become more reliant on their computers to provide detailed (and sometimes obscure) information, the immediate response is that it won't work. From the time they enter optometry school, students are told that they have to memorize details to pass Boards. Currently this is probably true and this makes the Part One NBEO Examination a major impediment to meaningful use of laptops in optometric education.

However, dropping Part One or revising the exam to make it more concept oriented has been considered. When this happens, the first two years of optometric education can change to focus more on problem solving skills and less on memorization of details that are often forgotten on the day after the examination.

If the evolution of Part One is such a good idea, why can't it take place today? There are several reasons. First, many faculty members who persist in teaching detail-oriented courses use the Board Exam as a motivational device during their lectures. How many times have students heard, "You have to learn this because it will be on Boards" from professors who cannot find a better reason for them to learn boring, trivial material?

The second reason might have to do with how the examination is constructed. No copies of previous exams are distributed, probably because a significant number of questions are reused. If students had computers during the examination, they could copy the questions and create a database of NBEO questions. In addition, students with network access during the exam could email questions and answers to others.

These problems are not insurmountable. For example, with a bit of creativity professors could make their presentations more active and relevant so that they would not have to rely on the NBEO motivator. Or perhaps the National Board could totally revise or simply eliminate Part One and rely on the Schools and Colleges to maintain quality control in their own educational programs.

Premise 6. Students who enter optometry school carry with them educational baggage from their previous experiences, but on day one of their first year, they are ready to learn in new ways. This could include innovative ways to use laptop computers.

Many schools and colleges have convocations in which entering first year students are greeted and given an orientation to their new lives. Typically they are told to work hard and join a student group because it is good for them.

However, they could also be told that their old habits of passively listening to professors and studying the day before exams will no longer work. Instead, they could be told that they will be taught exciting new ways to think, to use computer-generated information, and to solve complex patient problems. They would be excited and motivated by these prospects.

New students are ready for new things. However, on day two of the term they sit through dull lectures, find out about detail-oriented exams, and immediately regress back to high school survival-level learning styles.

Occasionally a student even expresses disappointment with professional education by saying that his or her undergraduate school was much more advanced and interesting than optometry school.

New students are ready for a change. Perhaps the trick is to get the faculty ready for change too.

Premise 7. Computer access to information is becoming so ubiquitous that patients often arrive in the examining room knowing more about their conditions than the doctor. Doctors and students must become facile in using their computers to find accurate information quickly.

A recent *Wall Street Journal* cartoon shows two doctors conversing; the caption reads, "With the Internet, my patients come self-diagnosed, have second opinions and already belong to a support group."[8] Although the cartoon is humorous, it represents reality. Patients are diagnosed with glaucoma and return in several weeks with questions on the latest clinical trials, programmed cell death theories, etc.[9] Then they ask the doctor questions that she or he cannot answer; so much for the all-knowing, god-like image of the doctor.

The doctor cannot know everything and cannot be as current as the Internet, so there will be an increasing emphasis on quick retrieval and evaluation of information, possibly in the presence of the patient. The doctor's role will then expand to include knowledge sales person and interpreter as well as diagnostician and disease manager.[10]

But this will only happen if the doctor has been taught sufficient computer skills and has access to databases that provide reliable information. Teaching computer skills is a task for optometry schools and the development of reliable databases is a project best managed by partnerships between schools, industry, and the government.

Premise 8. Computers are now an integral part of our lives and will become even more important in the future. For the generation of students now in grade and middle schools, computers are a fact of life and are not regarded as new or especially challenging. Teaching optometry students and faculty members how to use computers will be required only for a few more years until the generation of students who have used computers for their entire academic careers reaches optometry school.

Recently an optometrist and his daughters were touring Pacific and when the College's on-line CE program (http://www.opt.pacificu.edu/ce/) was explained to the optometrist, he confessed that he did not know how to use a computer very well. His 11-year-old then sat down at a Macintosh and with two sentences of instruction found the CE site, opened a course, and even showed dad how to take the exam.

Students now in optometry programs represent a transitional generation with respect to computer use. Some have used computers for many years and are very comfortable with them, but others are quite "computer-shy" and would rather have printed notes and work problems on paper.

Most faculty members have had little or no formal training with computers (or for that matter with educational techniques) and have picked up whatever computer skills they have on their own. For some senior faculty members, putting class notes on an Intranet and converting their transparencies to PowerPoint slides has been a great challenge and accomplishment.

Several faculty members have even argued that computers have little application in education or practice beyond billing and appointment making. But others have embraced computers more enthusiastically and have created simulation programs, instructional DVDs, in-class exercises involving the Internet, image databases, searchable class notes, and other computer-oriented learning aids. Students with laptops can take advantage of these aids on a 24/7 basis from home or campus.

Premise 9. Rapid advances in technology make any hardware or software you acquire today obsolete tomorrow. For this reason, some have argued that it is not logical to ask first year students to buy

computers that will be "junk" by the time they graduate.

One of the famous computer truisms is that you can buy any computer cheaper and better tomorrow, but if you wait till tomorrow you will be one day further behind everyone else. Evolution will make the computers that students buy during their first year of optometry school obsolete when they graduate. This is very different than the rate of obsolescence for similarly priced hardware like BIOs and it concerns some students and faculty members. A few have even naively suggested waiting until the student's third or fourth year to buy a computer so that it will be up-to-date when they graduate.

Many students wonder if they need a PDA instead of (or in addition to) their laptop, and tablet computers that interpret handwriting or drawings are just now being introduced. If the four-year-old Ethernet-wired classrooms at Pacific were to be built today, communication would probably be wireless. Computer-related hardware and software change in rapid and potentially expensive ways.

There is no endpoint in sight for computer development. To wait for a stable period in computer hardware and applications would be foolhardy. Students must jump in now and become expert computer users. Basic computer literacy or computer survival skills will just not be enough for 21st century doctors.

As computers evolve and as people become more comfortable with them, computers will assume a role in education and optometric practice no more noticeable than that of the hand calculator. They will simply become accepted facts of life, and future generations will wonder why there was any hesitation at all regarding integration of computers into optometric education and practice.

Summary

Based on these and other premises, Pacific has assumed a leadership role in the integration of computers into its academic and clinical programs. The questions that other schools and colleges of optometry now face is not whether to fully integrate computers into programs but when and how. To not integrate computers is to deny the inevitability of a computer-oriented future and to deprive their students of early experience with computer-assisted, activity-based optometric education.

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Disclaimer: The opinions presented in this article are based on many discussions with faculty members, students, and administrators at Pacific University. However, they are the personal opinions of the authors and do not necessarily represent the opinions of any other individuals or of Pacific University.

Industry News
(Continued from page 41)

percent of practitioners cited personal experience, or that of staff, with the performance of the drop as the most influential factor in determining which brand they recommend to patients.

Transitions Launches UV and Glare Discussions

Transitions Optical recently held UV and Glare roundtable discussions with doctors from various disciplines. The forum provided the opportunity for information sharing on UV and glare from optical industry professionals, as well as doctors of dermatology, pediatrics, and doctors in family practice and research.

"With the roundtable, for the first time, we're breaking ground by engaging other medical professionals as well. To address the problem of low awareness of the danger of UV and glare to the eye - a topic related to overall health and wellness - a cross-discipline approach is required. Through a two-way interaction, we can share information with other medical professionals on this topic while drawing from key learning they've developed from experience with patient education in their own areas," explained Dave Cole, Transitions general manager of the Americas.

B & L Celebrates 150th Anniversary

Bausch & Lomb, the global eye health company founded in 1853 by German immigrants John Jacob Bausch and Henry Lomb, celebrated its 150th anniversary on November 3, with chairman and CEO Ron Zarrella ringing the closing bell of the New York Stock Exchange that day. The company also became the first corporate patron of Vision 2020-The Right to Sight, a collaborative effort of the World Health Organization and the International Agency for the Prevention of Blindness, with a donation of $1million to the organization.

"Eighty percent of the world's blindness is avoidable, and treatments available today are considered to be the most successful and effective of all health interventions," Gullapli Nag Rao, MD, senior vice president and president elect of IAPB/Vision 2020, said. "As an outstanding corporate citizen of the worldwide community, Bausch & Lomb has stepped forward with

this generous donation to help bring the joy of sight to the people of the world."

Volk Optical Introduces New Lenses

Volk Optical, the industry leader in aspheric optics, has responded to the increasing demand for sterile optical supplies with the introduction of AutoClaveSterilizable (ACS) BIO lenses. These new lenses offer the same performance as traditional Volk BIO lenses with decreased processing time for sterilization.

The ACS BIO lenses can be safely steam-sterilized in-office using an autoclave, saving hours when compared to outsourced ETO gas sterilization. Available in 20D and 28D powers, these lenses provide high magnification for fundus examinations and are ideal for use in preoperative procedures.

Like all Volk lenses, the ACS BIO lenses are constructed of glass for a brighter and clearer image than plastic lenses. Volk's patented double aspheric technology provides undistorted views across the entire lens surface, eliminating blurring at the edges. AutoClaveSterilizable versions of select traditional indirect Volk vitrectomy lenses, ClariVit lenses and Chalam surgical lenses are also available as part of the Volk ACS collection.

Volk Optical is an innovator in the design and manufacture of diagnostic, therapeutic, and surgical ophthalmic lenses, equipment, and accessories. The company is based in Mentor, Ohio, USA, and has representatives and distributors around the world. To order or obtain more information about Volk products, visit www.volk.com, phone Volk at 1-800-345-8655, or contact your Authorized Volk Distributor.

Carl Zeiss Optical Unveils New Sales Structure

Carl Zeiss Optical recently unveiled its new sales department and sales team structure. The meeting marked the tenth year since Zeiss began wholesale lab partnerships, distribution of semi-finished lenses and AR equipment sales in the U.S.

Gary Shepson, formerly regional sales manager for the central region of the U.S., will be the new national sales manager, wholesale, and will be responsible for developing and maintaining relationships with Zeiss partner labs.

Robin Rhodes, formerly the regional sales manager for the Western region, is now director of sales, west. John Ditski, formerly regional sales manager for the Eastern region, is the director of sales, east.

"The meeting gave us an opportunity to introduce and discuss the new structure of our sales department," noted Roland Sitzler, Zeiss' vice president of sales. "The meeting provided essential information and resources for our sales team to share experiences, stay ahead of the competition, keep up with technology and market Zeiss products to the ophthalmic community."

Nike Vision Announces Spring 2004 Collection

Nike Vision, a leader in technologically advanced eyewear and sunwear, resurfaces in 2004 with a line of highly-evolved new sun styles. A variety of multiform, sport-specific and lifestyle frames are suitable for an expansive range of action.

From Nike Vision's Skylon collection emerges multifunctional and sleek new sun styles including Skylon's breakthrough EXP with a chromatic, multi-layered gradient flash lens. The EXP features an interchangeable dual lens system and is suitable for a variety of activities such as biking, running, beach volleyball and golf.

Nike's Skylon PRO EXP, designed for baseball/softball, running, cycling/mountain biking, and golf, features an interchangeable sport shield. Skylon PRO EXP, an edgy, utilitarian frame, utilizes Nike Vision's ventilated nose bridge as well as Flexon memory metal temples for enhanced fit and durability.

For spring 2004, Nike adds three smart new lifestyle designs to its sunwear collection, combining functionality with innovation. The Flywheel Square, Round and 3-Piece feature Nike Vision's Max Lens Technology and a bi-flex spring hinge for improved optics and fit. Nike Vision is distributed exclusively by Marchon Eyewear, Inc. Marchon, headquartered in Melville, New York, is one of the world's largest privately owned designers, manufacturers, and distributors of fashion and technologically advanced eyewear and sunwear.

Get *CONNECTED*!

CooperVision recently launched a new nationwide educational campaign, "Contact lens comfort - Get the conversation going," to raise awareness of lens discomfort and to help spread the word that we can in fact do something about contact lens comfort, according to Dr. Nikki Iravani, director of clinical research and professional relations, in *Connected*, Coopervision's monthly email newsletter. Other articles in the most recent issue of *Connected* were: "Fitting Tip: Proclear Compatibles Solves Dry Eye Concern"; "CooperVision's Frequency 55 Multifocal: A Balancing Act that Works"; and "Fitting Stock Prosthetic Lenses."

For more information, contact Connected@CoopervisionConnected.com

CIBA Adds New Marketing Positions

Ciba Vision announced the creation of two new marketing positions, which have been filled internally. Dwight Ackerman, O.D., has been named director of professional marketing, North America, and Warren Modlin, O.D., will serve as global head of professional marketing.

Ackerman most recently headed up global medical marketing for Novartis Ophthalmics based in Switzerland, while Modlin was manager of professional programs in Canada and part of Ciba's North American professional services group and North American marketing department.

In their new roles, Ackerman and Modlin will focus on the creation and execution of marketing programs that will assist eyecare professionals in growing their contact-lens practices. Ackerman will report to Jeff Cohen, CIBA's vice president of marketing North America, and Modlin will report to John Fadool, CIBA's global head of marketing, lens business.

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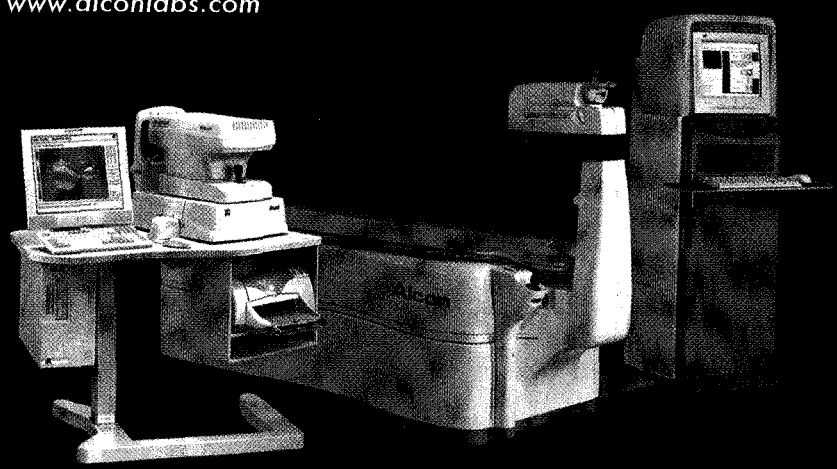

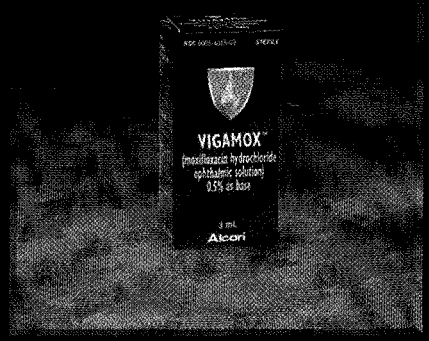

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