

# *Assistive Technology for People with* **Parkinson (or a similar) Disease and Impaired Vision**

The National Institute for Rehabilitation Engineering (NIRE) is an IRS section 501©3 charitable & non-profit organization which, for many years, operated clinics for the development and dispensing of Assistive Technology devices to people with many different types of permanent disabilities. These clinics assisted *hundreds* of people having permanently impaired vision - with personalized optical and electronic aids, user training, and employment assistance. This paper discusses clinical methods and devices successfully used - plus the newest technologies to 2006. Because the NIRE no longer operates its own vision clinics, its staff works with currently active clinics and clinicians to collect, analyze and report on data. The information is being made available in this and other papers so that it may help vision-impaired people everywhere to function more comfortably and independently based on help from local service providers. *PERMISSION is granted to freely copy and distribute this © paper provided all copies are complete and unaltered with The N.I.R.E. clearly identified as the source.*

## **PURPOSE ... of this Paper**

Parkinson Disease ( PD ) and other Parkinson-like diseases (called Parkinsonisms) frequently cause increasing vision problems as the illness progresses. By definition, Parkinson Disease (PD) is one variant of a family of similar neurologic diseases. PD is unique because many of the patients' symptoms respond rapidly and favorably to medications. When a patient has typical PD symptoms and they do not respond to the usual medications, the patient is said to have a "Parkinsonism" or Parkinson-like disease. Progressive Supranuclear Palsy (PSP) is one type Parkinsonism; Shy Drager is another.. While most or all conditions other than true PD do not respond to dopamine related medications, they often share similar movement, festination, balance, muscle, speech, swallowing and vision problems. **For the vision problems** described, the vision aids and techniques discussed in this paper may be considered and tried by individual patients.

This paper does not attempt to make diagnoses or offer medical advice. People with the disabilities discussed, should always consult their own neurologists, movement specialists, ophthalmologists and/or neuro-ophthalmologists, optometrists, optical dispensers, etc. This paper includes information concerning assistive devices to help handicapped individuals to function better or to see better when they must live with ongoing functional handicaps because nothing more can be done, medically, to "cure" their disorders and restore normal functioning. In this paper, we discuss a variety of lenses, optical aids, and electrical aids, etc. that seem to help some PD patients to see and function better.

## **Understanding The VISION PROBLEMS of PEOPLE with PARKINSON DISEASE**

**Reduced Visual Acuity:** As PD or a related disease progresses, many patients develop increasingly poor eyesight (functionally reduced visual acuity). This interferes with their abilities to drive, to read, to recognize people's faces, and even to watch television. Often, these patients notice that the types and varieties of vision loss change throughout the day, with time, medication schedules, and meal schedules.

Puzzling to some are the reports they receive from their eye doctors – that nothing is wrong with their eyes. The causes of these people's varying visual acuity are in the brain or nervous system, not the eyes. NOTE: Some PD patients do have eye conditions affecting both eyes or either eye, alone. These problems should be diagnosed, evaluated and corrected before buying low-vision aids.

**Gait, Balance and Walking Difficulties** can sometimes be improved, functionally, while using special lenses - for some people with PD or PD-like disorders. Reference is made to a paper previously published by this Institute which discusses the design, fitting and use of inexpensive prismatic prescription lenses for either or both of two purposes: (A) to help individuals having festination, gait and balance problems to balance and walk more normally, safely and comfortably with prism-lens eyeglasses; or (B) to help individuals with PSP (or similar eyegaze disorders) whose eyes are not able to look or see downward. Prism lenses can enable some to see downward, for safer walking, and – when seated - for reading, eating, and other purposes. This is the title of a paper discussing this problem - and its url address:

**NIRE Paper: Eyeglasses for People With Vertical Eye Movement Disorders and/or Ambulation Disorders - Eyeglasses for People Missing Lower Halves of Visual Fields or Unable to Gaze Downward**

[http://www.abledata.com/abledata\\_docs/Eyegaze\\_Disorders.htm](http://www.abledata.com/abledata_docs/Eyegaze_Disorders.htm)

[http://www.abledata.com/abledata\\_docs/EyeGazeDisorders.PDF](http://www.abledata.com/abledata_docs/EyeGazeDisorders.PDF)

SUGGESTION: For SAFETY, it is recommended that all eyeglasses intended for use while walking or standing be worn while being evaluated for walking abilities and safety by an experienced physical therapist or mobility trainer. Some mobility trainers experienced in using prism lenses may have trial glasses in their offices for evaluation use. Others who do not, can be asked to evaluate a patient in the office of an eye doctor or optical dispenser where different trial lenses can be used and compared. ###

**Concerning REDUCED VISUAL ACUITY**, the discussions which follow are based upon the assumption that the PD-affected people have normal eyes and should have normal vision, according to their ophthalmologists – but don't. This brings us directly to brain-related vision impairments resulting from PD and Parkinson-like diseases.

Clinical data suggest that the Best Corrected Functional Visual Acuity, for many moderately advanced PD patients (with normal eyes), ranges from 20/50 to 20/200. Often, the same person's functional acuity varies from hour to hour throughout each day and night, partly in response to his absorption and utilization of swallowed medications and meal and toileting schedules. **After six or seven years of using levodopa (Sinemet), many PD patients start to experience unexpected balance and motor-function ON and OFF periods. For many, the changes in visual acuity occur with balance and motor ON and OFF changes.**

Advanced PD patients whose eyes are in perfect condition, with no discernible eye disease, injury or defect, sometimes have neurologic based vision losses at all distances. Others' functional acuity may be better at some distances and worse at other distances. A particular person may have any one, or any combination of the functional vision losses described below, at any given time.

**A) Seeing Dim or Low-Contrast Images - with blurring** - of images described by normally sighted people as "bright and contrasty".- Due to abnormal brain functioning (possibly with varying dopamine levels), retinal images may be transmitted to and through the brain with reduced contrast and brightness levels. This often results in a person's seeing less clearly, even in bright light, as if trying to read detail at dusk, in dim light.

**Lenses and magnifiers may help a little, but do not completely compensate Inadequate Brightness-Contrast Perception syndrome.** If one is using a computer or a television, some improvement in apparent visual acuity may be obtained by turning up the display brightness and contrast levels while reducing background (room) lighting levels. Many who do this report they need higher screen brightness and contrast levels when there is brighter background lighting (than in dim background lighting). Some people with this problem report rapid but temporary improvement of visual acuity soon after ingesting Parcopa or Sinemet. Sometimes, just drinking a glass of water may help for a time.

**B) Double Vision** is common among PD patients, some using both eyes and others using just one eye. Either way, the double vision reduces the person's ability to see and discriminate fine detail, close or at distance. This may interfere with driving safely and reading print.

**(a) Some Causes of Double Vision Using BOTH Eyes:**

(1) misalignment or misconvergence of the two eyes. Normally, the two images, one from each eye, are seen as single, fully registered images. But, many advanced PD patients see images that overlap with edges and details misaligned. Double vision can occur in people with or without PD. An ophthalmologist or optometrist should examine and test the person for image "convergence" and "binocular fusion" at varying distances and under varying light conditions. If the misconvergence angles and overlap distances are constant with distance changes and over time, eyeglasses can be made that contain both ordinary distance corrections and specific prism convergence corrections. **Often, people with PD have varying visual convergence due to muscle control variations between the two eyes. This usually cannot be helped by fixed prism convergence correction.** This contrasts with people without PD who, more often, can be helped with prism lenses.

(2) Another common cause of double vision using both eyes is the PD itself, with the brain producing double vision in each eye, alone – and sometimes for the two eyes at the same time. This can result in a person's seeing (using both eyes) four overlapping but not registered images (instead of just two as with one eye). It is important for each person to have thorough examinations and tests by an ophthalmologist or optometrist to determine if, in his case, lenses or prisms may consistently help. Uncorrected, this type double vision often reduces a person's best corrected functional acuity from 20/20 to some value in the range 20/50 to 20/100. See NIRE paper:

"Helping People Who Have Double Vision (Diplopia)"

[http://www.abledata.com/abledata\\_docs/Double\\_Vision.htm](http://www.abledata.com/abledata_docs/Double_Vision.htm)

[http://www.abledata.com/abledata\\_docs/Double\\_Vision.PDF](http://www.abledata.com/abledata_docs/Double_Vision.PDF)

Binocular (using two eyes together) Diplopia may be caused by PD muscle interference in moderately to advanced PD patients. The dynamics of this are easily understood but not easily corrected or compensated. In people free of PD, the muscles that move each eye, usually function in complete coordination and synchronization for both eyes so there is no misconvergence and no double vision. In PD patients' systems, however, the eye muscles can experience non-synchronous spurious movements which can be compared to dyskinesias independently affecting arms and legs. Whenever a person's two eyes are moved asynchronously, the person sees blurred misconverged double images. Prism corrections are useless when the misconvergences are inconsistent and constantly varying.

**(b) Double Vision with Each Eye, alone or With just One Eye (if monocular).**

**Double Vision With One Eye** is almost unknown for people who not do have PD or a related disorder. Yet, it is common among people with moderate to advanced PD. This type double vision functionally reduces one's visual acuity – for distance (and driving) vision and for near vision, for reading. Weakened brightness & contrast levels - and the blurring or reduced acuity of monocular double vision - frequently vary over time and with medication intake schedules.. These disturbances are almost certainly caused by the PD and varied over time by the PD and the medications. This monocular double vision often reduces a person's corrected acuity from 20/20 to some value in the range 20/50 to 20/100.

**Monocular Double Vision** and/or **Focusing Difficulties** (in one eye or in both eyes) with PD may be caused, in part, by alternating conditions of "dry eyes" and "wet, watery eyes" due to malfunctioning of the autonomic nervous system. Eye examinations can confirm this and sometimes it can be controlled under medical supervision by adjusting the PD medications or with timely use of special eyedrops. Another frequent cause of blurring is believed to be abnormality in the transmission of signals along the brain's visual information pathways due to the effects of the PD or related disease.

**C) Lens - Focusing Problems** within the eye(s) may occur with advancing PD or related illnesses. Stiffness of the muscles that move the focusing lens within each eye can slow or even block the automatic focusing process so that it is not completed. This prevents the eyes from automatically and rapidly achieving best possible focus (and sharpness) for any particular viewing distance. The result is blurred vision.

Assume a particular person, without PD, sees a normal 20/20 at 20 feet, unaided, and also a normal 20/20 at 14 inches for reading, using +1.00 diopter reading lenses (for age related presbyopia). This person can read small print 20/20 at 14 inches any time, any day and always sees just as clearly. Why? Because his intraocular lens-focusing muscles always function with the same speed and accuracy in bringing about a sharp focus.

Another person of the same age is in his 8th year of Parkinson disease. He is tested under identical conditions but responds very differently. First, his best corrected acuity at specified distances is determined. Seemingly **Reduced Brightness and Contrast** detract from his acuity. **Double Vision** also reduces his functional acuity. Thus, even when his focal

distance is manually set for best acuity at a given distance using trial lenses, this person's sharpest vision may be only 20/70 or 20/100. Added onto these losses are the losses from inconsistent, **Inadequate Focusing** of the intraocular lens(es) controlled by tiny muscles within each eye. Just as the man walks unsteadily (festination) due to stiff muscles and imprecise control of the walking muscles by the brain, his eyes may focus unsteadily and inaccurately due to stiff muscles and imprecise control, by the brain, of the lens-focusing muscles within the eye.

Little can presently be done to treat or cure incomplete intraocular lens focusing. Sometimes, watching one of the PD patients at a computer or book, we see him moving his head in and out, toward and away from the screen or book, trying to find the best focal (sharpest vision) point for that distance at that time. If the range of change is small (say 2 to 4 inches), moving the head for best focus may be tolerable or even useful. But often, in practice, the head must be moved in and out over a range from 4 to 22 inches. This is uncomfortable and impractical for many PD patients because of muscle cramps ... or their body movement muscles may also be under varying, unreliable control. Medication and food intake schedules seem to affect some people with these problems, similarly to the ways hand dexterity, balance and ability to walk are affected.

**NOTE:** Some PD patients with one or more of these three basic visual acuity reducers - who wear prescription lenses - have discovered, by trial and error, comparative acuity testing: (all were people 50 or older using reading lenses) that: (1) prior to their PD problems, they had been able to see and read just as clearly using their expensive prescription glasses (single vision or bifocal) – as when using an inexpensive imported pair of reading glasses bought at a local "Dollar Store". And, (2) that after developing PD vision problems, they are able to see **MORE CLEARLY** with their costly prescription lenses than with the cheap store-bought reading glasses.

Further testing of these people and of non-PD controls brought some revealing answers to the researchers' questions. In those cases where there was significant improvement with prescription lenses over mass-produced lenses, it was found that the prescription lenses often had more than distance correction. Many of these lenses included astigmatism correction which was not present in the store-bought glasses. Often, when others who had been tested saw (equally poorly) with either type reading glasses, then both eyeglasses had similar distance correction but neither had astigmatism correction.

It appears that, with strong, reactive and synchronous functioning intraocular focusing muscles, the eye(s) are able to focus sharply and accurately enough to produce sharper images when uncorrected astigmatism is present, than when PD problems reduce, impede or impair the rapid focusing abilities of either eye or both eyes. Other significant variables were lens material: glass or quality composite lenses were almost always found to be better than cheap plastic (whether having molded or ground distance correction) and differing base-curves of the respective lenses. As a result, some PD patients who previously used store-bought reading glasses all the time, switched to using prescription reading lenses for sharper, better near vision.

**DISTANCE VISION** could not be evaluated the same way as reading vision because there are no cheap store-bought eyeglasses for correcting distance vision. Comparisons were

made, testing distance vision, alone, with each person alternately using (for distance): (a) single vision lenses with corrective prescriptions for best distance vision for each eye. And (b) bifocal lenses for each eye. For each PD patient tested, the distance portion of each lens had the exact same characteristics of the upper (distance) lens segments and that the single-vision distance lenses had. Theoretically, both sets of eyeglasses should have produced identical acuity determinations for each participant. **SURPRISE ... About half the vision-impaired PD patients who underwent this comparative acuity testing of Single-Vision-Glasses vs Bifocal-Glasses were found to see considerably better using the upper segments of their bifocal lenses.**

Why, we wondered? Further testing showed that by coordinated movements of head and eyes, the person moved the junction line – that which separates the distance segment from the reading segment – to within his field of vision. The presence of this line, perhaps acting in a manner similar to that of progressive lenses, enabled the person to manually focus his gaze for sharper imaging. Or, perhaps, the line edge may refract the light from wide-beam to narrow-beam status, much like looking through a pinhole. It was consistently found that this technique, using bifocal prescription lenses for distance vision (because of the presence of the junction lines), could often give the PD patient better vision at distance and at near – than otherwise attainable. Any local ophthalmologist or optometrist should be able to examine, trial-fit, evaluate and then write prescriptions for eyeglasses that can prove helpful to people with these needs. **NOTE: Some advanced PD patients may have head tremor or be unable to coordinate head and eye movements well enough to use the technique.**

**PINHOLE LENSES** - Some special pinhole vision aids that give sharp focus at all distances were tested. Several of these approaches seem to have possible merit for some PD patients. In response to inquiries about the usefulness of "**Pinhole Lenses**" to sharpen vision at all distances, tests were performed which separately used lenses having a single pinhole and other lenses, each having multiple pinholes. Yes, both single- and multiple- pinhole lenses yielded sharp, in-focus images at any distance and all distances. However, all the test subjects stated that they would NOT use such lenses on a regular basis because of their many shortcomings and disadvantages.

Among the shortcomings of pinhole lenses: (1) When the pinholes are small enough to yield focused, sharp images at any distance, the opening(s) are so narrow as to pass too little light. This makes such lenses usable outdoors in bright daylight, only. (2) Even under optimal outdoor, daylight conditions, the black borders seen surrounding each of the pinholes are annoying and distracting. And ... (3) The appearance to others of these lenses is often reported as "disturbing" or "unsettling." Since none of the people who tried pinhole lenses were willing to continue using them, we do not recommend pinhole lenses as a practical solution to the problems of PD vision.

## **Assistive Devices TO IMPROVE FUNCTIONAL PD VISION for use separately or in combinations, for any one or more of the functions described**

### **(1) NEAR VISION Activities (typically 8" to 16" from eyes)**

(a) **Reading and Writing, Eating Food, Sewing, etc.** are vision functions that depend on light reflected from the viewed objects into the person's eyes. Therefore, even and adequate (but not too intense) lighting should be used. It should be from incandescent bulbs for even color spectrum content – and NOT from fluorescent tubes or bulbs because of subliminal flicker and limited color spectrum.

Eyeglasses for reading print and for writing are most convenient as vision aids because of low cost and portability. The person should wear and use his or her regular prescription reading glasses, whether or not he uses other types of vision aids.. It is best if these are made and dispensed to prescription by an optician. ***Low cost imported reading glasses are best avoided.*** These glasses may have lenses of any of the types listed below:

**Single Vision Lenses** made to prescriptions for (near) reading/writing distances  
**Bifocal or Trifocal Lenses** with the lowest segment for (near) reading distances  
**Progressive Lenses** for reading-only, or as lower part of bifocal lenses.

Of the above listed lenses, the first was least useful; the second most useful, and the third of some benefit, to people having PD vision (reduced acuity) who tested and compared them.

Aids other than eyeglasses also exist for reading print. They are often best used with reading glasses rather than alone. One can search the internet for "Low Vision Aids" and find descriptions of, and suppliers for many aids. These are some of the potentially helpful devices available:

**CCTV Reading Magnifiers** (desk-located Closed Circuit TV print magnifiers – to 40X)  
**Optical Print Magnifiers** – Handheld and self-standing devices (multiple lenses – to 6X )  
**Electronic Print Magnifiers**, Handheld, Portable – for reading box labels in supermarkets  
**Simple Magnifying Eyeglasses**, Lightweight, Low-Cost but print must be very near face  
**Telescopic Magnifying Eyeglasses** – hand-focused to magnify print at distance from face  
(these can vary in cost from \$25 for mass-produced, to \$3500 for Rx custom made)

(b) **Computer & Electronic Large-Screen Magnified Displays** ( which includes various CCTV Magnifying Readers) have advantages and disadvantages over optical print magnification. **ADVANTAGES:** Image Brightness and Contrast are easily adjusted for optimal clarity depending on the ambient room lighting and the person's visual acuity. **DISADVANTAGES:** Most are not easily carried and portable, as are eyeglasses. Also, higher costs. **NOTE:** Reading glasses – or comparable computer glasses - should be worn when using a computer display. Because the user must be able to see downward, to the keyboard, and ahead/upward to the display screen, ordinary bifocals may not be optimal. Single-vision lenses are most often used but special "computer bifocals" can be made to be useful.

Some Informative Assistive Technology References on The Internet:

[http://www.cragside.com/accessability/cctv\\_readers/](http://www.cragside.com/accessability/cctv_readers/)  
[http://www.cragside.com/accessability/cctv\\_readers/optelec/index.html](http://www.cragside.com/accessability/cctv_readers/optelec/index.html)  
<http://www.nanopac.com/Optelec.htm>  
[http://www.neec.com/Vision\\_Rehabilitation\\_Service.html](http://www.neec.com/Vision_Rehabilitation_Service.html)

**Screen Magnification Software** is available for computers (both PCs and MACs) used by people with reduced visual acuity. These utilities function with all regular applications, allowing the user to magnify screen images as desired from 1.5X to as much as 40X. Some of these utilities also provide spoken output, through the loudspeakers. If the user of a PC with screen magnification also has a computer print scanner, then the need and cost for a CCTV reader may be avoided. Pages are scanned into the PC and the screen image is viewed with needed magnification. Reading scanned print is much slower, however, with a computer as compared with a stand-alone CCTV magnifier.

Interested readers are referred to: <http://www.aisquared.com>

**SAFETY CAUTIONS:** The use by PD patients of bifocal, trifocal, and progressive lenses; and of telescopic eyeglasses, is usually **safe while seated**, while reading – but **MAY BE UNSAFE** for use while standing or walking – unless the user has a clear and full-width view of his feet and the floor.

## (2) **INTERMEDIATE VISION Activities (typically 16" to 48")** **Preparing & Cooking Food, Gardening, Housecleaning, etc.**

Even and adequate (but not too intense) lighting should be used. It should be from incandescent bulbs for even color spectrum content – and **NOT** from fluorescent tubes or bulbs because of limited color spectrum and subliminal flicker.

The person should wear and use his or her regular prescription **INTERMEDIATE** glasses, whether or not he uses other types of vision aids.. It is best if these are made and dispensed to prescription by an optician. ***Low cost imported reading glasses are best avoided.*** The glasses may have lenses of any of the types listed below:

**Single Vision Lenses** made to prescriptions for intermediate distances

**Bi- or Tri- focal Lenses** with a segment for intermediate distances

**Progressive** - for reading-only, or as segments of multi-focal lenses.

**Simple Magnifying Eyeglasses**, Lightweight, Low-Cost but objects must be too near face

**Telescopic Magnifying Eyeglasses** – hand-focused to magnify print at distance from face (these can vary in cost from \$25 for mass-produced (such as opera glasses, manually focused), to \$2500 for Rx custom made bioptic telescopic glasses.)

Of the above listed lenses, the first was least useful; the second most useful, and the third of some benefit, to people having PD vision (reduced acuity) who tested and compared them. The fourth is useless for most tasks at intermediate distances. The fifth can be useful either way – but, for PD patients the expensive bioptic telescopic glasses are better and safer. **One can purchase a single pair of bioptic telescopic glasses with the telescopes each manually adjustable to focus at different distances. They can be 2X, 3X or 4X and can be focuses each time used, for near, intermediate or far distances.**

**SAFETY CAUTIONS:** Because these activities are usually performed while standing or walking, and because PD patients may have dizziness and/or balance problems, one should consider safety before using bifocals or trifocals. **Some people may safely wear bifocals where the one segment is for intermediate distance and is the full width of each lens. With these, the**

**person can see his feet and the floor or ground ahead.** We do NOT recommend use of READING bifocals or trifocals by PD patients while they stand or walk because of increased dangers of falling. Similarly, we recommend that handheld binoculars or non-biopic telescopic glasses not be used while standing or walking.

### **(3) DISTANCE VISION (typically 4 to 20 feet, and out to infinity)**

**SAFETY CAUTIONS:** Some people may safely wear bifocals where the one segment is for intermediate distance and is the full width of each lens. With these, the person can see his feet and the floor or ground ahead, clearly. It is recommended that PD patients not use walking glasses with a lower segment that does not show the feet and ground clearly.

**Reduced Functional Visual Acuity** as experienced by many PD patients, is often most evident with distance vision. This is true both indoors and outdoors and there aren't too many options. These are some helpful approaches to sharper, clearer vision at distance:

**Have your eyes examined** to be certain there are no vision problems other than PD. (If there are, have them treated before proceeding with the PD vision issues.)

**Obtain Rx distance glasses** – preferred: bifocals with intermediate lower segments. These are useful even if you don't need distance correction and the tops are plano.

**Learn To Use These Dynamically** so that the segment junction is your manual focus adjustment, used with simple movements of head and eyes.

**Wear a 6x or 7x Binocular** on a cord around your neck. Cost is low, under \$75.00, usually. You must hold this to your face, using your hands, with or without glasses, and manually focus it. Use only while seated, for your own SAFETY.

**Biopic Telescopic Glasses for Distance** are another, but costly, option.

These must be custom prescribed, made and fitted at a low vision clinic. If you choose to spend \$1800+ for these, get telescopes that have manual focus adjustments. The telescopes are mounted in the middle to upper part of each lens so you can see your feet and the ground, below the telescopes. Many low-vision clinic workers are unfamiliar with PD vision disorders and problems. Therefore, it is suggested you furnish them with a copy of this paper, and communicate to them, your own vision up and down times, medication and meal times, etc. Try to have them examine you when your vision is poorest.

The reason for people to buy these costly biopic (bifocal telescopic) glasses is that they can be worn and used, hands-free, while walking, riding in a car or (in some states but not all) while driving (with special training).

For more information concerning telescopic glasses, please go to:  
[http://www.enhancedvision.com/article\\_nt\\_opth\\_management.php](http://www.enhancedvision.com/article_nt_opth_management.php)  
[http://www.eyessociates.com/images/new\\_autofocus\\_ocutech.htm](http://www.eyessociates.com/images/new_autofocus_ocutech.htm)

## **MORE MEDICAL RESEARCH NEEDED for PD VISION**

because vision loss, as with almost all other symptoms of PD and related diseases, always worsens over time. At present, symptoms can, for a time, be compensated – but the underlying disorder, the continuing loss (death) of dopamine producing brain cells, cannot yet be slowed or stopped. So the process continues and the symptoms keep worsening. When, through Gene Therapy, Stem Cell Implants, or other such procedures, dopamine producing cells can be added to replace those lost – and the accelerated and continuing death of these cells can be slowed or stopped - then physicians will have effective treatments and cures. The measures discussed in this paper can only buy time until they are no longer effective enough. Therefore, readers are urged to support the efforts of the various PD foundations and patient support organizations that lobby for needed government research support and also, themselves, raise funds for active research. PD and related diseases are said to affect and disable over one million Americans, and more than two billion people throughout the world. These unfortunate people often live with the disease for as long as twenty five years, frequently in wheelchairs or bedridden, the last fifteen to twenty of these years. The cost in people's pain, suffering and in taxpayer dollars for long-term care are very substantial. Developing effective treatments would not only help the afflicted, but would ultimately cost the general population (taxpayers) far less than so many years of nursing home care for so many people.

**SELECTED INTERNET REFERENCES** for non-profit and commercial websites are included to illustrate specific types of low vision aids that were or are available. The non-profit N.I.R.E. does not recommend specific products, manufacturers or vendors and could not maintain a particular paper with always complete and up-to-date listings. Readers are free to perform internet searches for additional vision-aids and services information. We do recommend, however, that people interested in low vision products consult their own eye doctors, optical dispensers, low vision clinics or their own state Blind Services Agency for specific product recommendations, trials and referrals.

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For additional information or free technical support, please email: [nire@warwick.net](mailto:nire@warwick.net) or contact us by regular mail or telephone.

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