Introduction
My name is Dr Brian Evans. I am 64 years of age, and have albinism. My corrected eyesight is about 20/60.

I have spent most of my working life in scientific research. My retirement hobby is gaining a better understanding of my condition and communicating that information to people with albinism (and their families) and to eye care professionals.

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When I was a baby my Mother took me to see an Eye Doc. He said that I had albinism and would be blind by the time I was 5 years old.

My Mum took me to another Eye Doc who said that I was not albino and my eyesight would improve.

I re discovered that I had albinism when I was 58.
**Over the Pond**

Person with Albinism → Albino (Albeeno)

Manage the Condition → Fix It

Person without Albinism → Pigmento

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**Vocabulary**

In England albinism is far less of a social issue that in the USA. I therefore use the word Albino (pronounced Albeeno) without thinking that I might cause offence.

As an Engineer I also talk about ‘fixing’ things rather then ‘managing the condition’.

Finally Pigmento describes non Albinos.
The albino eye is over sensitive to light. There are two reasons for this.

The first reason is that there is no black pigment inside the eye. Open an old fashioned film camera and you will notice that all the insides are painted matt black. The inside of the normal pigmented eye is just the same – with a matt black coating that stops unwanted reflections. The albino eye does not have the black coating.
The lack of pigment inside the eye allows strong light to mask more dimly lit objects. The bright sunlight that enters through the window behind me makes it very difficult for people with albinism to see my face.
Mike, on the other hand, is standing away from the window. He is also standing under a ceiling light which makes him easier to be seen.

Mike McGowan is President of the Noah Albinism support Group in the USA.

www.albinism.org
Feeling Washed Out?

The picture on the right shows what happens when unwanted “back” light is allowed to enter the picture.

The left hand picture does not suffer from back light. Rather it suffers from too much light.

The middle picture is what I should look like.
Professional photographs use lens hoods to shield the lens from too much light.

People with albinism can achieve much the same effect if they wear a baseball cap.
Will wearing a Baseball hat fix the problem?

Nope

The baseball cap will prevent light from entering the eye from above. Sunglasses should be close fitting with a minimum distance between eyebrows and glasses. The sunglasses should also wrap around the sides to stop light entering from the side.

However, even with a baseball cap and good sunglasses there is still an excess light issue.
The eye control the amount of light by changing the size of the pupil. The iris is like a blind that can be drawn over a window to reduce the amount of daylight entering a room.

Some eyes have large pupils – some small. Most albino eyes have smaller pupils in order to help keep out the light.
The albino eye suffers from an effect called transillumination. The iris “blind” does not have any black pigment so the blind does not work too well in keeping out the light. The white of the eye – the sclera - also has no black pigment – so it lets in light as well.

This is not good news.
Trans-illumination

Ooophs !!

I have Fogged the Film

Perhaps we have all opened a film camera at some time – and discovered that there is a film inside. When the film is developed the image is blurry and washed out. Albino vision is just the same when there is too much light.
The wanted light that travels through the pupil reaches the retina at the back of the eye in good shape.

The unwanted light that trickles through the iris (and through the white of the eye) gets defocused in its passage through the “blind”. The unwanted light also reaches the retina – but it is no more than a blur.

The resultant image sent to the brain is a mixture of pupil light and iris light. In dim lighting this is not too much of a problem because the pupil opens up and lets more good light into the eye.
The four pictures shows what happens when the light gets brighter. As the light gets stronger the pupil area gets smaller – and the iris area gets bigger. Not only does less good pupil light enters the eye – but more bad blurry iris light gets through as well. The result is that our vision gets bleached in strong light.
PHOTOPHOBIA?

Quarter inch hole

Try the Black Cardboard Test

Look through your fist

Remember – strong iris light causes uncontrolled PAIN.

How can we fix the problem?

If we can cover the iris area while leaving the pupil area clear then the good pupil light can get through – but the blurry iris light is stopped.

One way is to look through a small hole in our fist. Another is to look through a quarter inch hole in some black paper or cardboard held up very close to the eye.
Try the black cardboard test. Cut a piece of black cardboard about 2 inches (5 cms) square and punch a quarter inch hole (6 mm) in the middle with an office hole punch. Hold the black cardboard tight against the eye and look through the hole.

80 percent of people with albinism notice an outstanding improvement in their vision – especially outdoors.
Black cardboard is impracticable for everyday wear – but coloured cosmetic contact lenses can perform the same feat. Daily disposable coloured contacts – with no script – will stop about 25 – 35 percent of the light going through the iris.

For a 100 percent solution to the iris light issue then a bespoke contact lens is probably the answer.

These contacts have a natural iris pattern pained on the front of the lens and have a matt black opaque black coating painted on the back of the lens – the side that touches the eye.
The regular soft contact lens covers the coloured iris part of the eye but does not extend into the sclera (white) part of the eye. If you naturally show a lot of “white” then the opaque contact lens may not be quite as effective.

However, most people with albinism tend to close their eyes – to keep out unwanted light – so in practice show very little eye white.

Cosmetic contact lenses cost very little whereas the pained opaque contact lenses are relatively expensive. Lens hygiene is very important if the lens is to be used for a period of months.
As part of the eye exam the eye Doctor will check the health of the retina at the back of the eye. He is not expecting a blond coloured retina – he expects much darker colouring.

So the eye Doc might believe that the albino retina is in bad shape – when it is really OK.
The retina at the back of the eye has a similar array of pixels to those in a digital camera.

The “rods” in the retina produce a black and white picture that has a definition of about 20/80.

The “cones” in the retina are found mostly in the middle of the retina. The cones provide us with colour vision and a central high definition visual acuity that ranges from 20/20 to 20/10.
The inside of the regular pigmento eye has a black pigment that stains the rod and cones – making it easy for the eye Doc to see them. The albino eye has very little pigment so there is no staining. The rods and cones are therefore almost impossible to see – but they are still there.
This is what the Eye Doc sees when he looks in your eye.

The left hand Pigmento picture shows a white blob at 3 o’clock where the optic nerve enters the eye
At 9 o’clock there is a dark patch which marks the hi def part of the retina.
In the right hand albino (my) eye the 3 o’clock optic nerve junction is smaller and at 9 o’clock there is no trace of the hi def retina.
Because the eye Doc cannot see the unstained cones then he may think that you haven’t any.

If you have colour vision then you have cones. Maybe not as many as you should – but you do have some.

Try this test. In a darkened room look at the red standby light on your TV set. Is it Red?

Now look at it out of the corner of your eye. If you (probably) have no cones in that part of your retina then the standby light will appear white not red.
The pictures in a newspaper are made up of dots. These are called picture elements – or pixels for short.

More pixels means better definition.
Over the past few years most of us have switched from old fashioned film cameras to digital cameras.

A 3 megapixel camera with a regular lens produces a picture that is approximately equivalent to 20 20 eyesight. A 6 megapixel camera produces the equivalent of 20 15 eyesight and a 15 megapixel camera is getting towards the equivalent of 20 10 vision – provided it has a good lens.

The following “20 20” pictures have been taken with a 3 megapixel camera. The pictures are approx 1500 pixels high.
The picture on the left was taken with a 3 megapixel camera and will have a print quality equivalent to 20/20 vision. On the overhead projector screen the definition may be reduced. The 20/200 images have been obtained by first reducing the number of pixels 100 fold – then increasing the resultant image 100 fold. Photoshop offers a number of ways of performing this transformation. The upper picture retains sharp edged pixels whereas the lower image softens the edge of each pixel. Essentially they are the same.

The 20/400 pictures are obtained in a similar way: 200 x down then 200x back up.
Both the above two-people pictures and the previous single person pictures show that a person with 20 400 vision can recognise people across a table without undue difficulty.
Someone with 20 200 vision would not experience undue difficulty in recognising the faces of a group of people maybe 10 feet away. Someone with 20 400 vision might struggle a bit.

But look carefully at the lady wearing the black T shirt. In the 20 20 picture it is possible to see the word “Noah” on the T shirt. In the 20 200 and 20 400 pictures the writing is no more than a blur.
This picture was taken from about 25 feet away. The middle top row picture is magnified 2 times and the right side top picture a further 2 times.

My face is recognisable all the way down to 20 240 but the writing above my head is not readable beyond 20 60.

Our brains are really good at recognising faces but new fangled writing is much too much of a challenge for someone with poor vision.
This picture shows a typical rural American street scene.

Apart from the signing there is very little difference between the 20 30 and the 20 200 versions of the scene.

If you know where you are going and don’t need to read the signs then, in my opinion, with care, legally blind 20 200 vision is not as dangerous as it might appear.
Bioptic Driving

Sat Nav ?

Miniature telescopes (Bioptics) that are attached to regular glasses are used for “spotting”. They are not intended for general road positioning – only for reading road signs.

UK medical opinion currently prefers the use of GPS satellite navigation rather than telescopes for driving.

Some US States allow bioptic driving provided that visual acuity with glasses or contacts reaches minimum standards. Some States do not permit Bioptics. Each State has different criteria.
Humans have been looking at natural objects for thousands of years. Only recently have Reading and Writing skills become necessary.

Our brain is good at seeing natural objects – even when our vision is technically poor. To Read and Write, however, our brain needs to work on a much better quality image.
As we have learned – the most difficult task for people with low vision is reading.

18 point text is OK for someone with 20/200 vision. But text sizes below 12 point offer increasing difficulty. The pink area at the bottom of the slide is a 2 times magnification of the 8 and 6 point text lines. The bottom right pink area is a further 2 times magnification of what 6 and 8 point text looks like to someone with 20/200 vision.

Reading small print has an easy fix – it just requires to be made bigger. i.e. Magnification.
This slide shows in close up what 18 and 8 point script looks like to someone with a shortage of pixels in the retina.

The pixel shortage hardly matters for 18 point script but makes a big difference for 8 point script.
One way of making things bigger is to get closer.

Children’s eyes can easily focus down to less than 4 inches so there is little harm in a low vision child sitting close to the TV set. For regular pigmento children there is a risk of developing short sight (myopia) if they undertake lots of close up visual tasks. Children should not be exposed to hours of 2D screen watching – in case the development of their 3D perception is inhibited.
The Story so far :-

A baseball hat and coloured contact lenses can make life outdoors as nice as life indoors.

20 200 vision is more than OK for “talking range” contacts, not too bad for driving, but crap for reading.
The next part of the presentation will discuss the size and shape of the eye.
The normal adult eye measures about 25 mm (an inch) from front to back. The front surface cornea and the internal crystalline lens usually have sufficient power to focus a far away object onto the retina – approx 22 mm behind the front surface.

If the eyeball is too small then an extra external glasses or contact lens can be used to add extra focusing power. If the eyeball is too big then a minus lens can be chosen to weaken the focusing power of the cornea.

Most albinos are far sighted – as the result of a small eyeball size.
Chinese students are known to be studious – and they are also known to be short sighted. This is a big problem for the Chinese – Why does short sight (myopia) happen and how many eye Doc’s will be needed to prescribe glasses for maybe 300 million people?

The photograph shows a school gathering in Hong Kong. Many of the students are wearing glasses. Some are also wearing masks – the photo was taken in 2003 at the height of the SARS outbreak in the Far East.
A good quality camera (film or digital) may have a chunky lens with a focus ring. Turning the focus ring makes the front of the lens move in and out – thereby placing the lens closer or further away from the film or digital sensor at the back of the camera.

When we focus the camera on something close the lens moves forward so as to increase the distance between the lens and the film.

They eye wants to try the same trick.
So the eyeball grows in size to achieve close focus without straining the eye.

But does not shrink again

Oophs!

To read something close-up the muscles in the eye have to control the internal crystalline lens that is set about 4 mm back from the front of the eye.

After a while the muscles get tired of all this work. They say to themselves – if the eye was a bit bigger – so the distance from the lens to the retina at the back of the eye was a bit longer - then we wouldn’t have to work so hard.

So the eye starts to elongate itself in order to take the load off the focusing muscles.
Short sight (Myopia) often develops between the ages of 5 to 15 years. The eyeball grows in length by up to 3 mm. The growth is usually seen as an extension bulge at the back of the eye rather than an increase in the overall size of the eyeball.

The retina lies within this growth area and may therefore experience more bending than in a normal eye. This extra flexing can lead to problems in later life. People who are very short sighted (more than -10 Dioptres) should monitor periodically the internal health of the eye.
Far sighted people are prescribed a plus lens to add extra power to their smaller than normal eyeball.

The eye is short of power by say 5 dioptres so a plus 5 dioptre glasses lens makes up the difference.

This forms a simple 2-lens Galilean telescope which provides some magnification (Good News) The Bad News is that there is a trade off between magnification and field of view. Someone wearing high plus correcting glasses will not be able to see where his feet are going – so may stumble on descending flights of stairs.
If eyeballs are generally too big or too small then short sight or long sight will result. There is also a chance, however, that the eyeball might be a little bigger or smaller in one direction compared to another.

Such irregularities are not unusual. Focus can be restored by using cylinder lenses as part of the overall glasses or contact lens script.

Most albinos have eyes that are a bit wider than taller. This is termed “with the rule” astigmatism.
When some of you were children perhaps you used a magnifying glass to start a fire or burn your friend’s arm. Do you remember how difficult it was to get the size of the spot really small. Tilting the lens made the spot change shape from a dot to a line.
If the eyeball does not have a round shape then the front of the eye – the cornea – cannot act as a perfect front lens.

Deviations from a perfect shape mean that the lens cannot manage a good focus in all directions at the same time.

What it can do, however, is to get a good horizontal focus but miss out on a good vertical focus. Or the other way round.

In the left hand part of the slide you can see both horizontal and vertical lines of the graph paper. On the right hand side the horizontal lines are still OK but the vertical lines are blurred and have almost disappeared.
I use a “Star Chart” to check for astigmatism. It consists of 40 spokes of a wheel that each get thicker as they move from the centre.

Someone with good eyesight – no astigmatism – will be able to see all the spokes equally well. For a person with albinism, however, he will probably see the 3 and 9 o’clock areas of the chart fairly well but will find the 12 and 6 o’clock axes a blur.

The eye Doc can (mostly) correct this blurring by prescribing cylinder lenses (cyl lenses) as part of the glasses script.
RNIB is the abbreviation for the UK Royal National Institute for the Blind. A few years ago I visited their exhibition and was surprised to see M I B written on some of their posters.

It took me a moment to realise my mistake.

My less than perfectly corrected astigmatism allows the R to merge into the adjoining N so as to form the letter M.
Horizontal blur is a big problem for albinos in which their astigmatism blur is East West. Letters run into one another.

Diagonal astigmatism blur (common among pigmentos) is not so bad.
If the astigmatism were to produce a diagonal defocus rather than a vertical defocus then the blurring of the letters would be different/better.

If you see a PWA reading with his head on the side you will know that he has uncorrected astigmatism!

Try to get it fixed with glasses.
Nystagmus is eye wobble.

Nystagmus can be acquired early in life or later on. There is a big difference in how the brain can handle Early and Late Nystagmus.

This may also be called Congenital (CN) and Acquired (AN) Nystagmus.
Look at the Capital A.

The horizontal bar of the A is in good focus but the legs of the A are fuzzy.

The eye says to itself – the horizontal is OK so I must be doing something right. Perhaps the verticals will improve if I hunt around a little.

Hence the eye wobble.

Nystagmus is a bad habit – learned early in life. Just like a stammer it takes a lot of un-learning.
There are two sorts of defocus – when the eye has wrongly focussed in front of or behind the object.

Short sight (myopia) produces a blurred picture when the object is too far away.

Long sight also produces a blurry picture – but with added halos (faint double images). These double images can fool the eye.

The above slide shows the effect of short sight astigmatism (termed “against the rule”) and far sight (“with the rule” astigmatism) which is common among people with albinism.
Early Onset Nystagmus

The infant brain finds a way to reduce the effect of eye shake.

Late Onset Nystagmus

Visual images are processed in the back of the brain in an area described as the visual cortex. Studies have shown that a sub-area – termed V3 - is used to track fast motion – without us even thinking about it.

However, if nystagmus is present, something amazing happens.

Within a few months of birth this V3 auto-track function is reassigned to take the shake out of the images arriving from the wobbly eye.

Once assigned to anti-shake duties the “software” cannot be re-assigned to its original auto-track function.
This loss of the auto-track functionality means that the albino eye can now only track moving objects under “manual” control. Response time is much slower because it requires a conscious effort to track a fast moving object.

Under manual control it takes a split second to first recognise that the object is moving – then a lot of conscious effort to track its movement.

Without the regular fast auto-track function in place it is therefore extremely hard to catch a ball or follow a fast moving sport.
“Seeing” people in a moving car is very difficult.

Most Albinos cannot “lock on” to low contrast & fast motion.

Albino eyes take a long time to “lock onto” someone going past in a car – and mostly do not bother to do so.

By the time your friends in a passing car have shouted at you – and you have manually locked onto their presence – they are gone!
The Story so far :-

A baseball hat and coloured contact lenses can make life outdoors as nice as life indoors.

Astigmatism correction can reduce Nystagmus

20 200 vision is more than OK for "talking range" contacts, not too bad for driving, but crap for reading.

Fast ball games are a No No
Been there; Tried them:-

You will notice that many people with albinism at this conference are not wearing glasses.

It is not for the want of trying – they all have lots of pairs of glasses in a drawer back home.

Why do they give up on glasses?
For many albinos a trip to the eye Doc has proved to be a waste of time and money.

Why is it that there are no lenses that can fix their eyesight?
Is it time to go Home?

Or is there more to the Story??
Most eyes enjoy a regular contour – but some do not.

Imagine a fly by night construction company who built most of the hotel to the correct dimensions on the plan – but who got some of the dimensions wrong. Most rooms were the correct size – but some were bigger or smaller than expected.

A standard lens can correct an eye that is too big or small overall – but cannot correct localised variations.
The slide shows table spoons on the left and soup spoons on the right.

The soup spoon is symmetrical but the table spoon is not.

If the spoons are new and shiny then you can see your face in their “mirror”.
If I look into a table spoon the reflection of my face is distorted.

If the shape of my eyeball has a sag then the mis-shape in the lenses in the eye will distort and defocus the image reaching the retina.
Top of the Irregular Astigmatism list is the adverse effect of cataract surgery
Cataract surgery requires a cut to be made in the side of the eye. The crystalline lens – which has become opaque with age is replaced with a synthetic one.

Often enough the surgery introduces irregular astigmatism. The patient does not complain because his eyesight is much better once the cataract has gone – though his sight may not be as good as 10 years previously.
The swapping out of the old lens for a new one has been done successfully millions of times.

Most surgeons make a small cut in the corner of the eye in order to swap the lens. Some surgeons, however, prefer to make a cut further away from the iris so that the resulting dimple in the surface of the cornea is further away from the pupil / iris area.

This procedure, however, does cause more bleeding and a longer recovery time.
About 1 in 2,000 people suffer a distortion of the front of the eye termed keratoconus (Cone Eye). This typically can occur between teenage and 40 years of age.
The bulge in the cornea has a big impact on the ability to see clearly.

In the past the treatment has been a special contact lens or a corneal graft (from a donor)
Disclaimer

Much of what I am about to describe might be termed as ‘experimental’. I am not endorsing any of these procedures.

If, however, these procedures become necessary for other clinical reasons then it is useful to understand their possible benefits.
Keratoconus is being treated in a new way. It is believed that the bulge in the cornea is a result of a structural weakness in the front of the eye.

This technique aims to produce a transparent tough coating on the front of the eye – just like the rind on a cheese.
Quiz Time.

What is the connection between a breakfast cereal and a group of dancers holding hands?
Researchers have discovered that the front surface of the cornea can be strengthened by increasing the number of cross links between the cells of collagen. This can be achieved by painting the eye with Riboflavin – Vitamin B – and fusing it into the surface of the eye by means of low energy UV light.

Unlike the high energy dental filling procedure - exposure time is 30 rather than 3 minutes.

This produces the required collagen cross linking.
If the number of unused pairs of glasses is anything to go by – albinos have irregular as well as regular astigmatism.
This slide shows a contour map of my right eye. It shows that the top of my eye has a corneal surface power of 49.3 Dioptres whereas the bottom of my eye has a power of 48.5 Dioptres. They should be the same value.

This shows that I have an irregular astigmatism of 0.8 of a Dioptre – which cannot be fixed with regular glasses but MIGHT be fixed with rigid contact lenses.
The earlier black cardboard test (T) used a quarter inch hole.

The pin hole test (P) uses a hole about a tenth of an inch in diameter.

Look through the pinhole with the top, bottom and sides of your pupil.

Do you notice a difference in visual acuity?
Have you ever pressed your finger against the side of your eye.

You will notice a rotation and a change in vision.

If you have no irregular astigmatism then ANY press will make your vision worse.

If you do have an irregularity then pressing the eye MAY improve your vision.
To date the corneal cross linking has been used for strengthening the front of the keratoconus eye.

The technique might also tighten the surface of the front of the albino eye – thereby reducing the irregularity.
Progressive or varifocal lenses have been around for some time. The top of the lens is designed to give good distance vision whereas the bottom of the lens is designed to provide added power for reading.

The white area provides excellent vision (for pigmentos), the green area provides fair vision but the no-go red areas provide poor vision and are to be avoided.

It is the red areas that interest me – because they provide distortion. With trial and error (and a bit of luck) a number of albinos have noticed a distinct improvement in their vision when looking through the red no-go areas of a progressive lens.
What else is in the Box?

So far we have covered Long/Far Sight, Short Sight, Astigmatism and pin hole lenses.

There remains another interesting technique – that of adding Prism to the script.
Which is Better?  
One Eye or Two?

Fellow Eye - Binocular Vision

TWO eyes are 41% better than ONE

The brain expects our two eyes to work together in partnership. Each eye encourages the other to develop. In the albino brain, however, the visual pathway partnership is not set up properly so each eye develops independently of the other. This can lead to lazy eye or a strabismus / squint.

Non-albino people with normal vision (pigmentos) sometimes suffer from double vision when their usual eye partnership breaks down.
Pilots need to have good eyesight. Military pilots need to undergo a further training program that allows each eye to accept different information from instruments attached to their helmet.

People with albinism are quite used to seeing different images with each eye. On the other hand albinos have very little binocular vision.
A prism bends light.

If we hold a prism in front of one of our eyes then the eyeball will rotate in order to correct the bend that was introduced by the prism.
Eye Docs use prisms to align our binocular vision in much the same way that the auto repair shop makes adjustments to the alignment of the wheels on a car.
A car has 4 wheels – so maybe it is better to think of two-eye binocular adjustments as the same as aligning the two wheels of a motor bike.

In which case does it make any sense to talk about aligning the single wheel of a unicycle?
If a pigmento needs a full eye check then the Eye Doc will first fix the script. (long/short sight etc)

Only then will the Doc use prisms to check that both eyes are working well together.

Guess what – albino eyes aren’t so well behaved.
It is generally accepted that binocular vision develops when you are young. If the eyes are not aligned by the age of 4-8 then the chance of acquiring binocular vision are much reduced.

I have a strabismus so have virtually no binocularity.

What did I discover when I tried prisms on myself?
We all know that Home Theater sounds best with an HD BlueRay 5.1 Dolby sound track – the binocular option. If only I knew how to operate the remote!

But Home Theater also makes old videotapes and vintage TV shows sound much better too – the enhanced monocular option.

I found that prisms gave me an enjoyable quasi binocular experience – and my eyes felt much more relaxed.
I also began to realise that some prisms made things wider or taller. I took the prisms back to the lens lab to have them checked – they were perfect at bending light – nothing else.

So why was I experiencing a change in the shape and size of things I could see?
With the help of my local optometry practice I had my eyes tested on a regular autorefractor.

The first test was to look straight into the machine.

In the subsequent tests I was naughty. I held a prism between my eye and the machine. The machine was kidded into thinking that I was still looking straight – but my eye was, in fact, looking sideways.
I had chosen prisms that I knew made a big difference to the shape of things.

When I used the prisms the autorefractor said that my astigmatism varied quite a lot. (2 Dioptres)

In other words my script was changing significantly when I looked sideways.
From the way I move my head and eyes it seems that I am trying to look through a pane of glass with raindrops on it.

A slight change of gaze angle seems to make a big difference.

I knew that gaze angle changed my script – would a change in head angle do the same?
In some parts of the world you can buy prism glasses that allow you to watch TV in bed without straining your neck.

The prism bends the image from the TV set so that you need only one pillow rather than three.
The classic albino null position is head down – gaze up.

What happens if we raise our head and then use TV glasses to straighten the gaze?.

Will the vision be the same as at null point?

For Pigmentos – Yes
For Albinos  -  Maybe not
I notice that my vision changes when I tip my head on the side.

I can test this by looking at the star chart. As I move my head my ability to focus on the centre of the star chart changes. The central defocussed blurry area changes shape.

I also notice that, with my head on the side, my vision can improve if I twist my glasses.
Distance eyesight is usually tested at a distance of 20 feet. Regular autorefractors are set up to test at that distance.

The French Imagineyes refractor is different. It allows eyesight to be tested at various distances – from a few inches to beyond 20 feet.

In order to accommodate these changes in distance regular eyes will change the power of the crystalline lens – just like a camera lens focus adjustment.
As the image is brought forward from 20 feet to maybe 6 inches away the crystalline lens gently increases in power.

This is shown in the blue ‘Sphere’ line on the graph of a young pigmento eye.

Any Astigmatism (red line) does not change.
When I took the test my ‘sphere’ reading did not change. This was fully expected since I am well past the age that I need reading glasses.

What was far more interesting was that my crystalline lens astigmatism (red line) went wild.

When we repeated the test a few more times the astigmatism changed over the same 1 Dioptre range – but in a different fashion.
So far I have shown that my script changes with gaze angle and head angle.

Any success I might have in focussing on nearby objects is quite random. My glasses cannot keep up with what my crystalline lens is up to – because it is different all the time.

Are there any other issues?
Focus in albino vision focus (accommodation) can change all the time – and for no apparent reason.

My eyes have been extensively tested by eye Docs who discover that my astigmatism script changes minute by minute.

As they take off some of the trial lenses from the test frame I have remarked –

Oh, That’s nice! They are alarmed.
Teenagers sometimes complain of poor vision – but are they telling lies.

One credibility test is to hold a plus lens in front of the eye and then cancel the effect with the addition of a minus lens.

If vision is now 20 20 then the eye Doc will probably report that the teenager was lying about his poor vision.

Or was he?
It has been suggested that attention deficit in children with Down’s may be a consequence of a temporary loss of focus in the eye.

Adults with Down’s often experience wide variations (3 DS) in script from one eye check up visit to the next.

In West Wales (UK) there has been a long term study of eyesight in 72 children with Down’s.

Bifocal glasses (Add 2 DS) were introduced to counter the change in script.
The result of the trial has been encouraging.

At first the children used the top or bottom of the bifocal lens in order to get best vision.

After 2 years of use, however, the unwanted variation in script has diminished and the bifocals no longer provide a benefit.

Has the 2 Dioptre jerk taught the eye to focus more consistently?
The reason that visits to the eye Doc can prove unsatisfactory is probably the result of our constantly changing refractive error.

The eye Doc can suggest a refractive correction – but will this script still work a second or a minute or an hour or day after the test.

How can we reduce this variation?
The focus of a pigmento eye is mainly achieved by the internal focus muscles attached to the crystalline lens.

In the albino eye there is also an unwanted interaction both with the external muscles that change the gaze angle and the more distant muscles that move the head from side to side and up and down.

Perhaps this unwanted interaction is caused not by the muscles themselves but by the interaction of the nerves that control the muscles.

How can we check?
Cataract operation. (Clear Lens Exchange)

One way to fix the focus problem is to take away the troublesome crystalline lens and replace it with a fixed focus plastic one.

No longer can the internal muscles change the performance characteristics of the lens so the script should now be more stable.

Millions of cataract operations have been performed worldwide and the procedure has a relatively low risk.
How to Fix it -- Perhaps

- Swap out the lens

> Freeze the muscles

- Cut the nerves

A less aggressive and more temporary fix is to use anaesthetic eye drops.

The eye drops make the pupil much bigger and stop the internal focus muscles working.

The external gaze muscles still work OK.
Eye Drops

Pupil gets bigger

Auto focus stops working

Pigmentos:

Will need dark glasses and a friend to see them home

Eye Docs use eye drops to make the pupil bigger thereby making it easier to see the back of the eye.

Unfortunately the bigger pupil lets in more light and makes the pigmento photophobic.

The internal focus muscles stop working so his vision drops from 20 20 to maybe below 20 200 at some focus distances.
The albino eye takes all this in its stride.

Eye drops – No problem!

Photophobia and poor focus are old news so a little more of the same from the eye drops is no big deal.

In fact the bigger pupil lets in more Good Light so vision might improve.

I have met albinos who regularly does themselves with eye drops for better vision.
Eye Drops fix the changes due to -

Raindrops

Near–Far Focus

BUT: We now need varifocal glasses

When the eye drops stop the internal focus muscles from working then the interaction issues also go away.

The eye is no longer affected by gaze angle and head angle – whatever effect there might have been is now a constant not a variable.

However, in order to see properly over a range of distances we will now need to wear progressive (varifocal) glasses.
So far we have swapped out the crystalline lens for a plastic one and stopped the focus muscles working by means of a local anaesthetic.

Maybe the culprits are the nerves themselves (the instructors) rather than the muscles (the GIs)

Some researchers have used Gabapentin (a relatively mild anti epilepsy drug) to soothe the nerves and reduce nystagmus.
At the United Nations John Boulton is privately advised on what to say by his team of advisors. We don’t get to hear what they tell him.

Maybe it’s the same with nerves – some public conversations and other more private whispers.

The Chevy truck engine is much the same. The public conversation is the gas pedal, the private whispers are the environmental sensors for temperature, pressure, CO2 etc

I am told that the Chevy engine runs just fine without the “whispers”.
Prof Lou Dell’Osso thought that the external eye muscles were carrying unwanted extra whisper signals that caused nystagmus. His surgeon, Richard Hertle, disconnected more muscles than is usual for strabismus surgery and reconnected them in the same place. The nystagmus was reduced - presumably because the nerves in the muscle remained disconnected after the muscles were re-attached.

This research was first carried out on Briand dogs who often suffer congenital nystagmus.
Research undertaken by Prof John Marshall in the UK indicates that the elasticity of the eye is influenced by genetics.

Maybe the regular pigmento eyeball has the firmness of an apple whereas an albino eye might be more squashy inside – like a tomato.

Perhaps the internal albino eye structure is not strong enough to properly control the crystalline lens and warps when the muscles contract. This may lead to internal irregular astigmatism.
I hope that I have shown that the albino retina may not be as bad as first feared and that improvements in vision can be made.

I have suggested that, for many albinos, the irregular geometry at the front of the eye might cause part of the reduction in vision.

I have also suggested that the crystalline lens may be receiving a whole bunch of negative whispers that it might do better without hearing. Tenotomy might be the first step in a long line of possible improvements.
Post Script:

After my presentation Dr Brilliant showed me this comparison of pigmento and albino mouse eyes.

We hypothesised that the black melatonin bricks might be there to add stiffness and thickness to the internal structure rather than just provide a black matt surface.
Full Circle

Albino? Yes

Blind by 5? No Way!

And now for that Beer!

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