



1
00:00:05,030 --> 00:00:03,030
every year about 400 000 americans are

2
00:00:06,789 --> 00:00:05,040
diagnosed with cataracts

3
00:00:09,030 --> 00:00:06,799
they are the leading cause of blindness

4
00:00:12,390 --> 00:00:09,040
worldwide and the most common cause of

5
00:00:15,430 --> 00:00:12,400
vision loss in the united states

6
00:00:17,430 --> 00:00:15,440
today the only cure is surgery but

7
00:00:20,150 --> 00:00:17,440
thanks to a nasa scientist

8
00:00:20,790 --> 00:00:20,160
other treatments may be on the way dr

9
00:00:23,670 --> 00:00:20,800
rafat

10
00:00:25,029 --> 00:00:23,680
ansari began designing a new method to

11
00:00:27,670 --> 00:00:25,039
diagnose cataracts

12
00:00:30,230 --> 00:00:27,680
14 years ago when his own family was

13
00:00:32,630 --> 00:00:30,240

affected by the disease

14

00:00:34,150 --> 00:00:32,640

my father developed cataracts very

15

00:00:38,310 --> 00:00:34,160

really personal story

16

00:00:41,990 --> 00:00:38,320

and i did not know what a cataract is

17

00:00:42,869 --> 00:00:42,000

okay so i tried to go to some doctor's

18

00:00:45,350 --> 00:00:42,879

offices

19

00:00:47,270 --> 00:00:45,360

and found out what a cataract is and

20

00:00:48,630 --> 00:00:47,280

they told me that this is the cloudiness

21

00:00:50,630 --> 00:00:48,640

of the lens

22

00:00:51,990 --> 00:00:50,640

i asked them if there is a treatment for

23

00:00:53,110 --> 00:00:52,000

it and they said no there is no

24

00:00:55,510 --> 00:00:53,120

treatment for it

25

00:00:56,470 --> 00:00:55,520

and when i will grow old i will get it

26

00:01:01,029 --> 00:00:56,480

myself

27

00:01:03,590 --> 00:01:01,039

and the only treatment is a surgery

28

00:01:05,990 --> 00:01:03,600

ansari didn't like what he was hearing

29

00:01:07,910 --> 00:01:06,000

so he decided to find out more about the

30

00:01:10,070 --> 00:01:07,920

disease that caused his father

31

00:01:12,230 --> 00:01:10,080

and millions of other americans to have

32

00:01:14,630 --> 00:01:12,240

surgery every year

33

00:01:15,270 --> 00:01:14,640

so i spent just out of curiosity one

34

00:01:17,190 --> 00:01:15,280

weekend

35

00:01:18,710 --> 00:01:17,200

at a library at case western reserve

36

00:01:20,310 --> 00:01:18,720

university in town

37

00:01:21,990 --> 00:01:20,320

at their medical library and went

38

00:01:23,270 --> 00:01:22,000

through some literature to find out what

39

00:01:26,310 --> 00:01:23,280

exactly it is

40

00:01:29,990 --> 00:01:26,320

and i learned that there are

41

00:01:31,109 --> 00:01:30,000

three different proteins in the lens of

42

00:01:33,190 --> 00:01:31,119

the eye

43

00:01:35,749 --> 00:01:33,200

and those proteins are called alpha beta

44

00:01:39,590 --> 00:01:35,759

and gamma crystallines

45

00:01:42,069 --> 00:01:39,600

in a normal lens of the human eye

46

00:01:44,069 --> 00:01:42,079

the protein crystallines are the size of

47

00:01:47,109 --> 00:01:44,079

few nanometers

48

00:01:50,630 --> 00:01:47,119

and as we age

49

00:01:53,030 --> 00:01:50,640

or there are any other

50

00:01:54,069 --> 00:01:53,040

problems in the human body then these

51
00:01:56,870 --> 00:01:54,079
proteins

52
00:01:58,469 --> 00:01:56,880
would or or if there is a we are

53
00:02:01,590 --> 00:01:58,479
subjected to the radiation

54
00:02:02,630 --> 00:02:01,600
exposure okay as the astronauts do then

55
00:02:06,069 --> 00:02:02,640
these proteins

56
00:02:10,790 --> 00:02:06,079
agglomerate and they form

57
00:02:14,390 --> 00:02:10,800
bigger sizes if the size becomes so big

58
00:02:16,710 --> 00:02:14,400
that it starts to obstruct

59
00:02:18,470 --> 00:02:16,720
the light which is falling on the retina

60
00:02:21,430 --> 00:02:18,480
with which we can see

61
00:02:24,229 --> 00:02:21,440
at that point in time a cataract is

62
00:02:28,229 --> 00:02:26,470
it just so happened that ansari was

63
00:02:30,070 --> 00:02:28,239

studying the behavior of proteins and

64

00:02:31,589 --> 00:02:30,080

experiments on the international space

65

00:02:33,910 --> 00:02:31,599

station

66

00:02:34,790 --> 00:02:33,920

as a scientist at nasa's glenn research

67

00:02:37,670 --> 00:02:34,800

center

68

00:02:39,589 --> 00:02:37,680

he used a laser technique called dynamic

69

00:02:41,910 --> 00:02:39,599

light scattering technology

70

00:02:44,470 --> 00:02:41,920

to examine tiny protein molecules

71

00:02:47,350 --> 00:02:44,480

suspended in liquid

72

00:02:49,350 --> 00:02:47,360

dynamic light scattering means looking

73

00:02:51,990 --> 00:02:49,360

at the motion

74

00:02:52,949 --> 00:02:52,000

of something whether it is being

75

00:02:58,470 --> 00:02:52,959

suspended in

76

00:02:59,270 --> 00:02:58,480

fluid so if you're talking about a

77

00:03:01,190 --> 00:02:59,280

liquid

78

00:03:02,309 --> 00:03:01,200

the way the scientists would like to use

79

00:03:05,589 --> 00:03:02,319

this is that

80

00:03:08,790 --> 00:03:05,599

they would pass a light beam through

81

00:03:12,149 --> 00:03:08,800

a fluid if this fluid contains

82

00:03:12,630 --> 00:03:12,159

a plane simple water the water molecules

83

00:03:14,710 --> 00:03:12,640

are so

84

00:03:16,309 --> 00:03:14,720

small compared to the wavelength of

85

00:03:19,830 --> 00:03:16,319

light that they would not

86

00:03:20,309 --> 00:03:19,840

scatter any light but if the particle

87

00:03:22,790 --> 00:03:20,319

size

88

00:03:23,990 --> 00:03:22,800

starts to grow and it come becomes

89

00:03:26,229 --> 00:03:24,000

comparable

90

00:03:27,509 --> 00:03:26,239

to the wave the size of the wavelength

91

00:03:30,229 --> 00:03:27,519

of the light

92

00:03:30,869 --> 00:03:30,239

then it would scatter light and if you

93

00:03:33,509 --> 00:03:30,879

collect

94

00:03:35,110 --> 00:03:33,519

that light it will give you lots of

95

00:03:36,949 --> 00:03:35,120

information

96

00:03:39,589 --> 00:03:36,959

could the same technology be used to

97

00:03:42,630 --> 00:03:39,599

detect proteins in the human eye

98

00:03:44,789 --> 00:03:42,640

ansari was determined to find out so

99

00:03:46,390 --> 00:03:44,799

determined that he asked his teenage

100

00:03:48,550 --> 00:03:46,400

daughter for help

101
00:03:50,229 --> 00:03:48,560
and the two of them began an unusual

102
00:03:54,149 --> 00:03:50,239
experiment

103
00:03:56,869 --> 00:03:54,159
we went to a local abattoir

104
00:03:57,429 --> 00:03:56,879
okay or a place where you can get the

105
00:04:03,670 --> 00:03:57,439
eyes

106
00:04:05,429 --> 00:04:03,680
to my house okay we were not set up at

107
00:04:07,350 --> 00:04:05,439
that time here nasa to do those kind of

108
00:04:08,229 --> 00:04:07,360
experiments but just out of curiosity

109
00:04:11,350 --> 00:04:08,239
got the eyes

110
00:04:14,630 --> 00:04:11,360
took it to home and i have never done

111
00:04:15,670 --> 00:04:14,640
any dissections in my life so i asked my

112
00:04:18,789 --> 00:04:15,680
daughter

113
00:04:21,590 --> 00:04:18,799

and she was at that time in ninth grade

114

00:04:23,110 --> 00:04:21,600

okay so i asked my daughter i said could

115

00:04:25,270 --> 00:04:23,120

you please dissect this

116

00:04:27,189 --> 00:04:25,280

for me i want to look at what lens looks

117

00:04:28,950 --> 00:04:27,199

like in the eye

118

00:04:31,510 --> 00:04:28,960

so she dissected the kawaii in the

119

00:04:33,670 --> 00:04:31,520

kitchen of our house

120

00:04:36,390 --> 00:04:33,680

my wife obviously was complaining that

121

00:04:38,550 --> 00:04:36,400

what we are doing but she did it anyway

122

00:04:40,550 --> 00:04:38,560

and then my wife asked well it's dinner

123

00:04:44,230 --> 00:04:40,560

time let's go have dinner

124

00:04:46,310 --> 00:04:44,240

so i took the lens put it in a glass jar

125

00:04:47,670 --> 00:04:46,320

filled with water and put it in the

126

00:04:50,950 --> 00:04:47,680

fridge

127

00:04:53,350 --> 00:04:50,960

okay just to say that it doesn't go bad

128

00:04:55,270 --> 00:04:53,360

came up after a couple hours opened the

129

00:04:57,670 --> 00:04:55,280

fridge took this thing out

130

00:04:58,390 --> 00:04:57,680

and now what i see is that the clear

131

00:05:05,110 --> 00:04:58,400

lens

132

00:05:06,950 --> 00:05:05,120

and when they become opaque that means

133

00:05:09,110 --> 00:05:06,960

it's a cataract

134

00:05:11,430 --> 00:05:09,120

but this was a great model for me to

135

00:05:13,909 --> 00:05:11,440

study so very quickly i took that

136

00:05:15,670 --> 00:05:13,919

put it in a beaker put a thermometer in

137

00:05:16,550 --> 00:05:15,680

it and it started to reduce the

138

00:05:19,670 --> 00:05:16,560

temperature

139

00:05:21,510 --> 00:05:19,680

and we used the device that we made for

140

00:05:22,629 --> 00:05:21,520

space experiments the dynamic light

141

00:05:25,430 --> 00:05:22,639

scattering device

142

00:05:25,990 --> 00:05:25,440

and start to take the measurements from

143

00:05:33,270 --> 00:05:26,000

the

144

00:05:35,350 --> 00:05:33,280

a portable probe

145

00:05:36,310 --> 00:05:35,360

that peers into the eye without touching

146

00:05:38,150 --> 00:05:36,320

it

147

00:05:40,230 --> 00:05:38,160

the probe recently underwent clinical

148

00:05:41,909 --> 00:05:40,240

testing at the national institutes of

149

00:05:45,350 --> 00:05:41,919

health

150

00:05:48,870 --> 00:05:45,360

today i'm very pleased to report

151
00:05:51,749 --> 00:05:48,880
that we just finished a pretty

152
00:05:53,029 --> 00:05:51,759
good size clinical study on the

153
00:05:56,790 --> 00:05:53,039
validation

154
00:06:00,070 --> 00:05:56,800
of this device which perhaps

155
00:06:02,710 --> 00:06:00,080
would lead now to find a medical cure

156
00:06:03,909 --> 00:06:02,720
for cataract and the reason i'm saying

157
00:06:07,430 --> 00:06:03,919
this is because

158
00:06:10,230 --> 00:06:07,440
everyone at nih and here at nasa

159
00:06:11,909 --> 00:06:10,240
we are very excited about this because

160
00:06:15,350 --> 00:06:11,919
this device is about

161
00:06:17,830 --> 00:06:15,360
three orders of magnitude more sensitive

162
00:06:19,029 --> 00:06:17,840
than anything else out there right now

163
00:06:21,350 --> 00:06:19,039

which is being used

164

00:06:23,749 --> 00:06:21,360

for detecting cataract at a very early

165

00:06:26,230 --> 00:06:23,759

stage

166

00:06:27,510 --> 00:06:26,240

the probe is so effective that it can

167

00:06:31,029 --> 00:06:27,520

detect cataracts

168

00:06:32,790 --> 00:06:31,039

long before patients experience symptoms

169

00:06:34,070 --> 00:06:32,800

this is allowing doctors to experiment

170

00:06:36,309 --> 00:06:34,080

with new drugs

171

00:06:37,590 --> 00:06:36,319

that might stop the disease dead in its

172

00:06:39,670 --> 00:06:37,600

tracks

173

00:06:42,150 --> 00:06:39,680

but that's not all the technology may

174

00:06:45,990 --> 00:06:42,160

lead to treatments for other diseases

175

00:06:47,590 --> 00:06:46,000

you have heard the one of the adults

176

00:06:51,670 --> 00:06:47,600

there which says that

177

00:06:54,390 --> 00:06:51,680

i is a window to the soul

178

00:06:55,110 --> 00:06:54,400

we are trying to change that i is not

179

00:06:58,629 --> 00:06:55,120

only

180

00:07:02,629 --> 00:06:58,639

a window to the soul but i is also

181

00:07:05,510 --> 00:07:02,639

a window to the human body because

182

00:07:07,189 --> 00:07:05,520

every tissue type and every fluid type

183

00:07:10,230 --> 00:07:07,199

in the human eye

184

00:07:10,629 --> 00:07:10,240

represent every tissue type every fluid

185

00:07:13,350 --> 00:07:10,639

type

186

00:07:15,189 --> 00:07:13,360

in the human body and the potential

187

00:07:18,550 --> 00:07:15,199

applications are

188

00:07:20,309 --> 00:07:18,560

amazing and very huge so this and some

189

00:07:21,589 --> 00:07:20,319

related technologies that we developed

190

00:07:24,790 --> 00:07:21,599

here at nasa

191

00:07:27,029 --> 00:07:24,800

are now helping us to study

192

00:07:28,150 --> 00:07:27,039

not just the lens of the eye for the

193

00:07:30,710 --> 00:07:28,160

cataract

194

00:07:31,430 --> 00:07:30,720

but also to look at the disease of the

195

00:07:33,589 --> 00:07:31,440

brain

196

00:07:35,029 --> 00:07:33,599

which is say alzheimer's disease or

197

00:07:37,350 --> 00:07:35,039

parkinson's disease

198

00:07:38,629 --> 00:07:37,360

and we could study that through the lens

199

00:07:41,670 --> 00:07:38,639

of the eye as well

200

00:07:44,230 --> 00:07:41,680

because the beta amyloid proteins

201
00:07:45,110 --> 00:07:44,240
which are the culprits for alzheimer's

202
00:07:46,629 --> 00:07:45,120
disease

203
00:07:48,710 --> 00:07:46,639
or somehow i do not know the

204
00:07:49,830 --> 00:07:48,720
biochemistry of it but somehow are

205
00:07:55,990 --> 00:07:49,840
expressed

206
00:07:59,110 --> 00:07:58,390
ansari continues to study non-invasive

207
00:08:02,390 --> 00:07:59,120
methods

208
00:08:04,230 --> 00:08:02,400
for diagnosing diseases someday

209
00:08:07,350 --> 00:08:04,240
he hopes these methods will protect

210
00:08:11,029 --> 00:08:07,360
astronauts on future missions to mars

211
00:08:12,550 --> 00:08:11,039
the ultraviolet radiation on a regular

212
00:08:15,589 --> 00:08:12,560
day

213
00:08:18,869 --> 00:08:15,599

on mars is about

214

00:08:22,950 --> 00:08:18,879

800 times higher

215

00:08:25,029 --> 00:08:22,960

than a summer day here on earth

216

00:08:26,550 --> 00:08:25,039

which means that if you are not

217

00:08:29,670 --> 00:08:26,560

protecting the astronauts

218

00:08:33,750 --> 00:08:29,680

on mars they are at

219

00:08:37,110 --> 00:08:33,760

very high risk for say skin cancer

220

00:08:38,230 --> 00:08:37,120

and for other things as long as the eye

221

00:08:40,630 --> 00:08:38,240

health is concerned

222

00:08:42,550 --> 00:08:40,640

we know that ultraviolet radiation is

223

00:08:44,710 --> 00:08:42,560

very bad for the eye as well

224

00:08:46,470 --> 00:08:44,720

so for the space applications what we

225

00:08:49,829 --> 00:08:46,480

would like to really know

226

00:08:53,509 --> 00:08:49,839

is that before these astronauts develop

227

00:08:55,750 --> 00:08:53,519

any symptoms and with the development of

228

00:08:57,750 --> 00:08:55,760

new nanotechnology with the development

229

00:08:59,269 --> 00:08:57,760

of new pharmaceutical products coming in

230

00:09:00,389 --> 00:08:59,279

that nasa is working with some other

231

00:09:03,430 --> 00:09:00,399

people

232

00:09:04,150 --> 00:09:03,440

could that be utilized okay that they

233

00:09:08,310 --> 00:09:04,160

are kind of

234

00:09:09,910 --> 00:09:08,320

sitting in the human body as you can

235

00:09:13,030 --> 00:09:09,920

call them kind of robots

236

00:09:15,670 --> 00:09:13,040

miniature robots micro robots of

237

00:09:17,590 --> 00:09:15,680

atomic dimensions and as soon as we

238

00:09:20,829 --> 00:09:17,600

detect that something is happening

239

00:09:22,949 --> 00:09:20,839

they would go and treat that particular

240

00:09:25,190 --> 00:09:22,959

problem

241

00:09:27,829 --> 00:09:25,200

with nasa preparing to send astronauts

242

00:09:30,150 --> 00:09:27,839

to the moon and eventually to mars

243

00:09:31,670 --> 00:09:30,160

ansari's probe could someday make human

244

00:09:34,949 --> 00:09:31,680

exploration of space

245

00:09:37,910 --> 00:09:34,959

a safer endeavor meanwhile