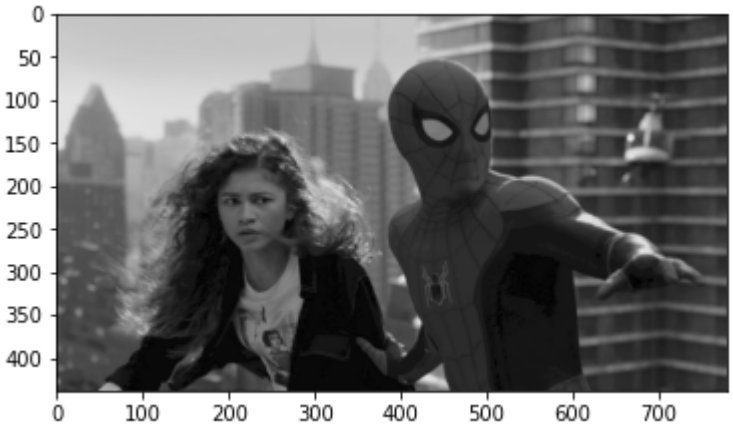
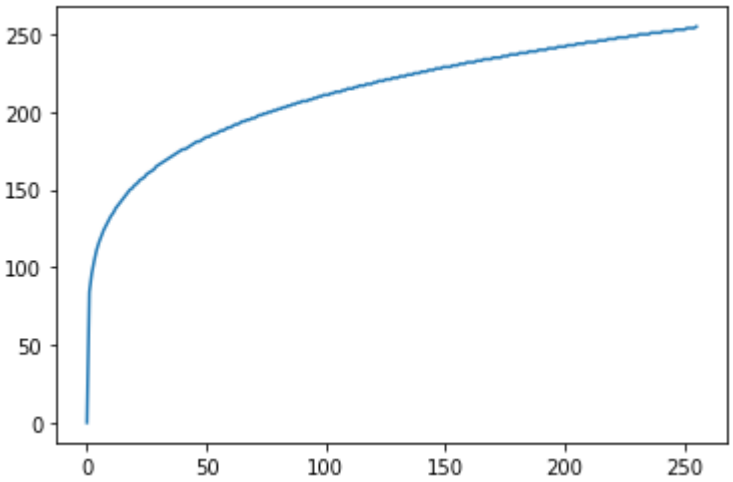
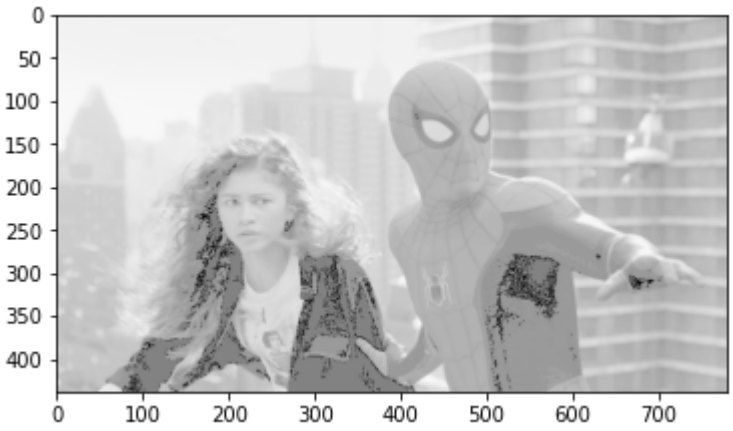
In [2]:
```
import numpy as np
import cv2 as cv
import matplotlib.pyplot as plt
```

In [3]:
```
f = cv.imread(r'spider.png',cv.IMREAD_GRAYSCALE)
assert f is not None
gamma = 0.2
t = np.array([(p/255)**gamma*255 for p in range(256)]).astype(np.uint8)
g = cv.LUT(f,t)
newf = cv.cvtColor(f,cv.COLOR_BGR2RGB)
newg = cv.cvtColor(g,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(newf)
fig2,ax2 = plt.subplots()
ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(newg)
```

Out[3]:
```
<matplotlib.image.AxesImage at 0x2855b8175e0>
```

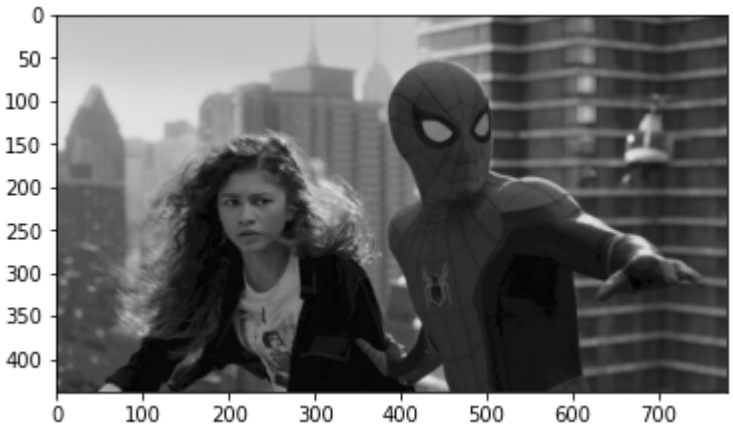


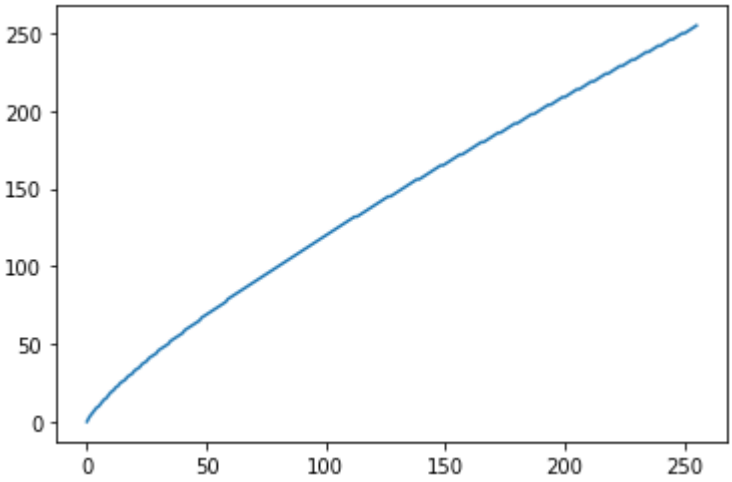


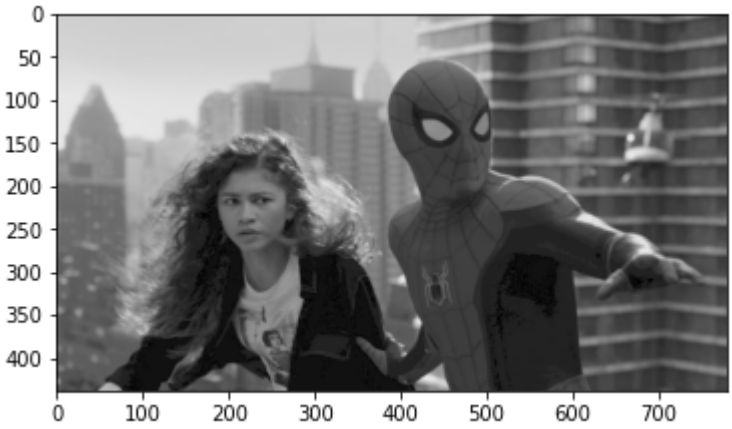


In [4]:
```
gamma = 0.8

t = np.array([(p/255)**gamma*255 for p in range(256)]).astype(np.uint8)
g = cv.LUT(f,t)


newf = cv.cvtColor(f,cv.COLOR_BGR2RGB)
newg = cv.cvtColor(g,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(newf)
fig2,ax2 = plt.subplots()
ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(newg)

# cv.namedWindow('Image',cv.WINDOW_AUTOSIZE)
# cv.imshow('Image',f)
# cv.waitKey(0)
# cv.imshow('Image',g)
# cv.waitKey(0)
# cv.destroyAllWindows()
```

Out[4]:
```
<matplotlib.image.AxesImage at 0x2855e9ea7a0>
```

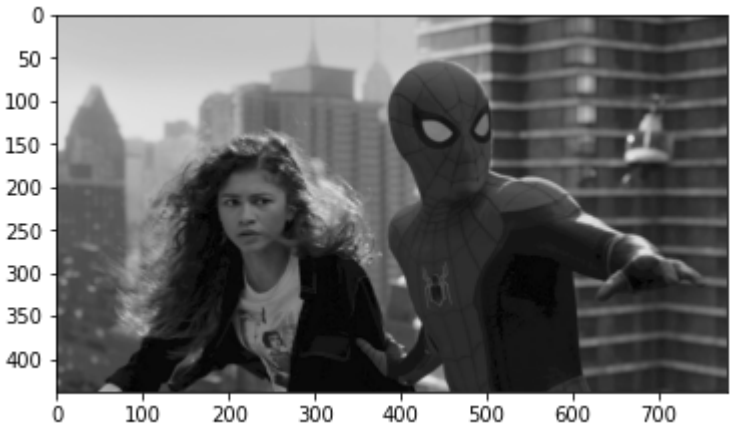


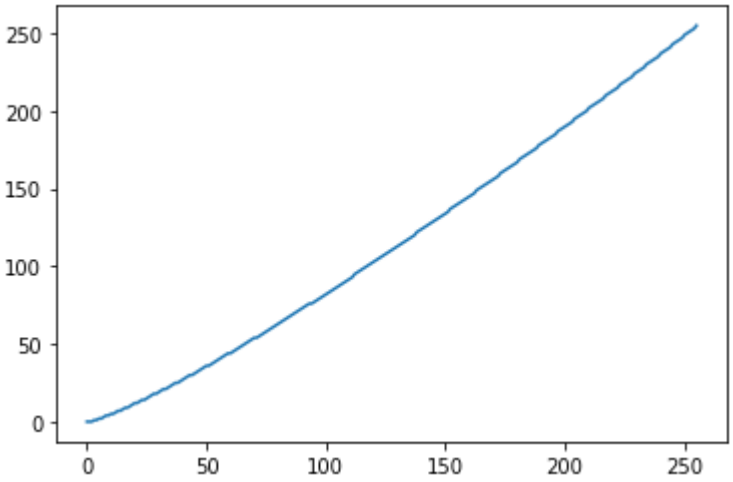


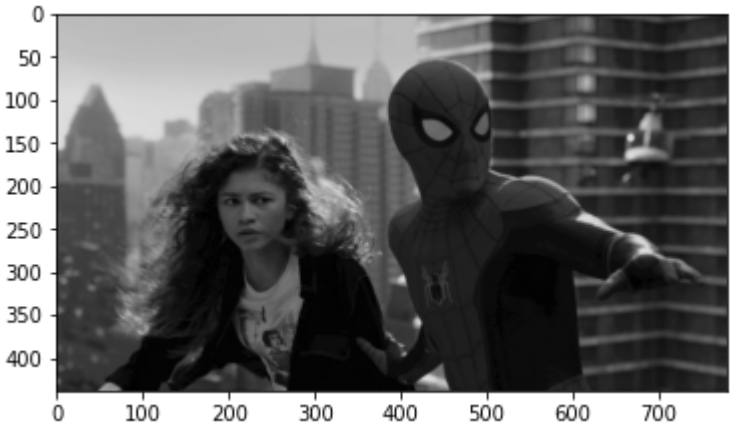


In [5]:
```
gamma = 1.2

t = np.array([(p/255)**gamma*255 for p in range(256)]).astype(np.uint8)
g = cv.LUT(f,t)

# fig,ax = plt.subplots()
# ax.plot(t)

newf = cv.cvtColor(f,cv.COLOR_BGR2RGB)
newg = cv.cvtColor(g,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(newf)
fig2,ax2 = plt.subplots()
ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(newg)

# cv.namedWindow('Image',cv.WINDOW_AUTOSIZE)
# cv.imshow('Image',f)
# cv.waitKey(0)
# cv.imshow('Image',g)
# cv.waitKey(0)
# cv.destroyAllWindows()
```

Out[5]:
```
<matplotlib.image.AxesImage at 0x2855eb2ecb0>
```





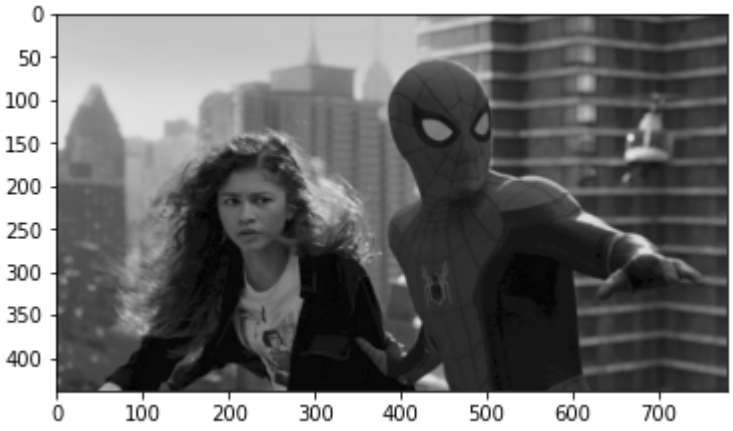


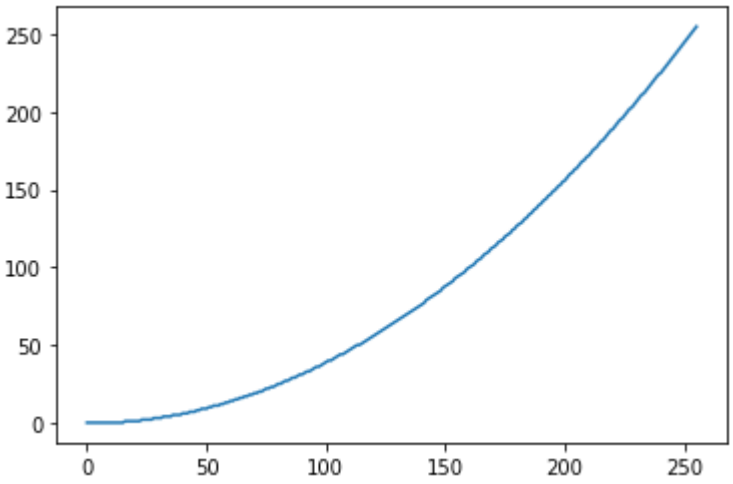
In [6]:

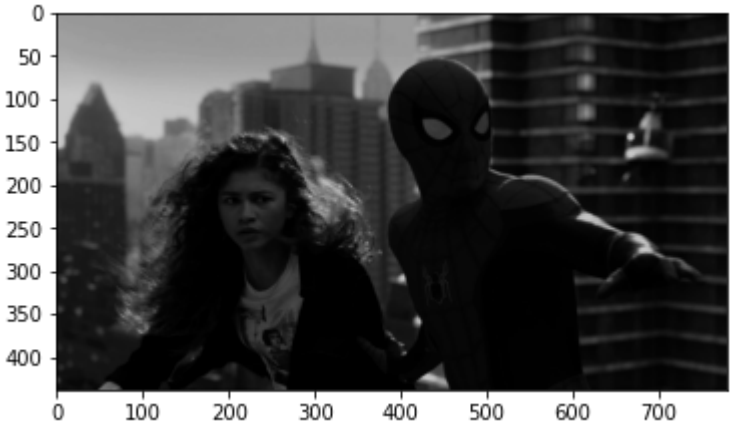
```
gamma = 2

t = np.array([(p/255)**gamma*255 for p in range(256)]).astype(np.uint8)
g = cv.LUT(f,t)

# fig,ax = plt.subplots()
# ax.plot(t)
newf = cv.cvtColor(f,cv.COLOR_BGR2RGB)
newg = cv.cvtColor(g,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(newf)
fig2,ax2 = plt.subplots()
ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(newg)
```

```
# cv.namedWindow('Image',cv.WINDOW_AUTOSIZE)
# cv.imshow('Image',f)
# cv.waitKey(0)
# cv.imshow('Image',g)
# cv.waitKey(0)
# cv.destroyAllWindows()
```

Out[6]: <matplotlib.image.AxesImage at 0x2855ec77130>



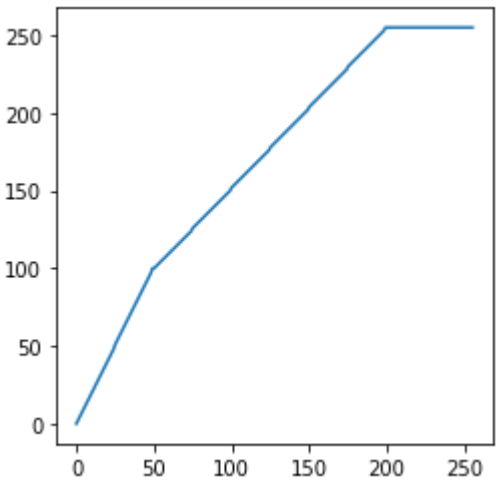


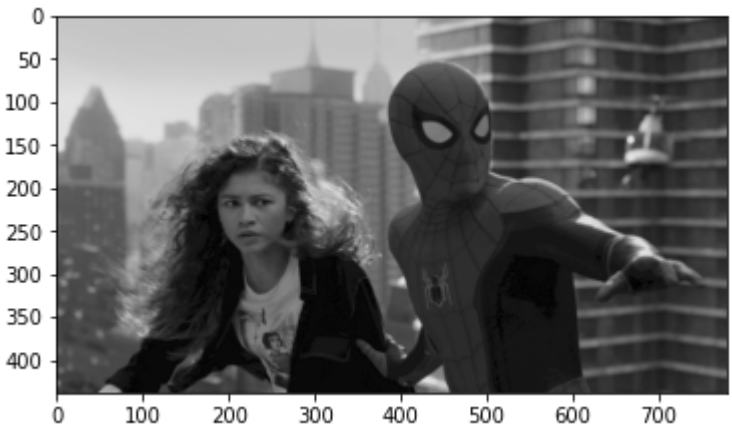


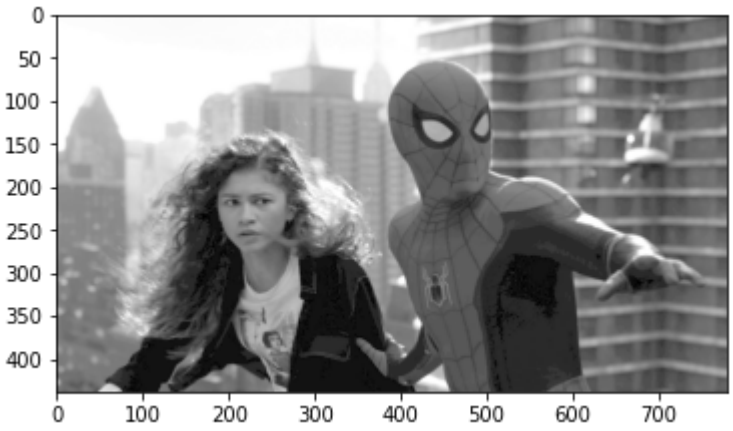
In [7]:
```
f = cv.imread(r'spider.png',cv.IMREAD_GRAYSCALE)
assert f is not None

gamma = 0.2

t1 = np.linspace(0,100,50)
t2 = np.linspace(100,255,150)
```

```
t3 = np.linspace(255,255,56)



t = np.concatenate((t1,t2,t3),axis=0).astype(np.uint8)


fig,ax = plt.subplots()
ax.plot(t)
ax.set_aspect('equal')
assert len(t) == 256

g = cv.LUT(f,t)

newf = cv.cvtColor(f,cv.COLOR_BGR2RGB)
newg = cv.cvtColor(g,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(newf)
# fig2,ax2 = plt.subplots()
# ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(newg)
# cv.namedWindow('Image',cv.WINDOW_AUTOSIZE)
# cv.imshow('Image',f)
# cv.waitKey(0)
# cv.imshow('Image',g)
# cv.waitKey(0)
# cv.destroyAllWindows()
```

Out[7]: <matplotlib.image.AxesImage at 0x2855edafe80>

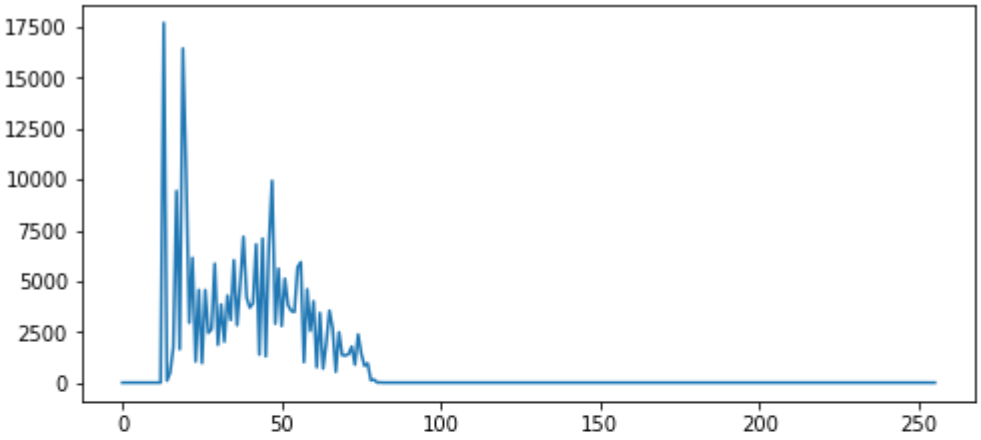


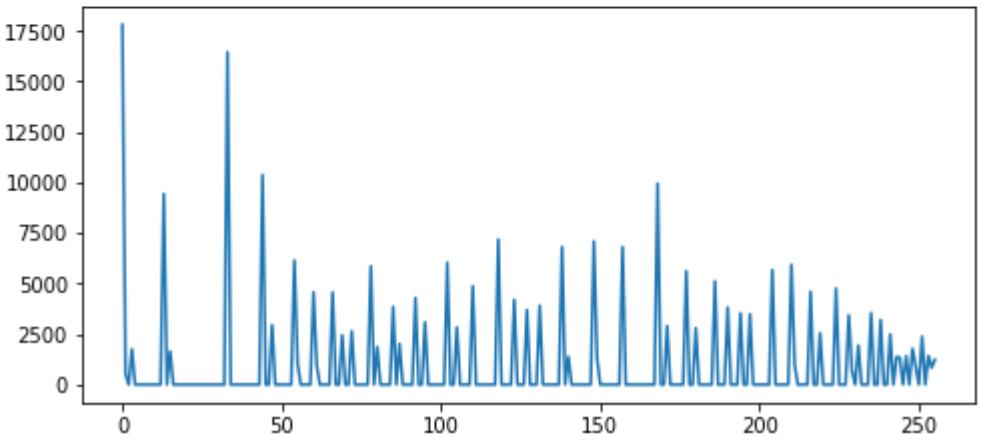


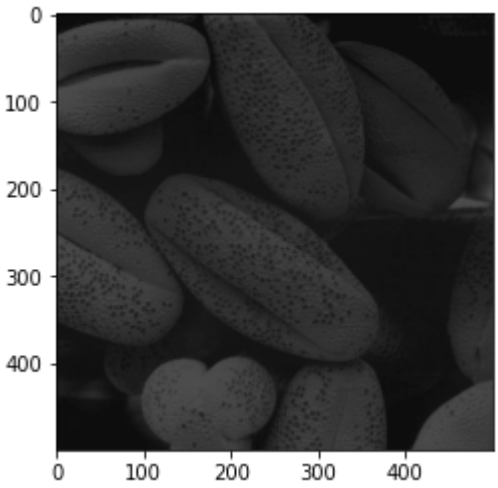


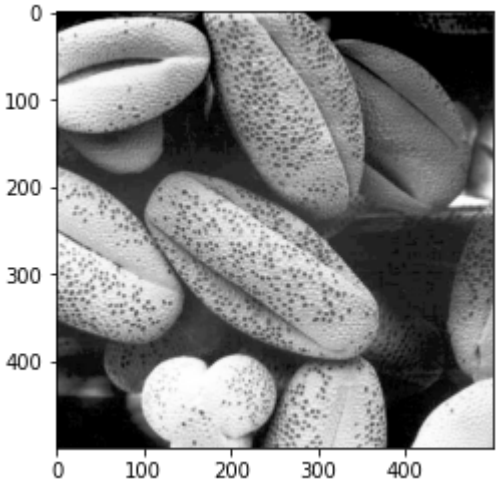
In [8]:
```
f = cv.imread('shells.tif',cv.IMREAD_GRAYSCALE)
assert f is not True

hist_f = cv.calcHist([f],[0],None,[256],[0,256])
g = cv.equalizeHist(f)
hist_g = cv.calcHist([g],[0],None,[256],[0,256])
fig,ax = plt.subplots(2,1,figsize=(8,8))
ax[0].plot(hist_f)
ax[1].plot(hist_g)


newf = cv.cvtColor(f,cv.COLOR_BGR2RGB)
newg = cv.cvtColor(g,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(newf)
# fig2,ax2 = plt.subplots()
# ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(newg)

# cv.namedWindow('image',cv.WINDOW_AUTOSIZE)
# cv.imshow('Image Before',f)
# cv.waitKey(0)
# cv.imshow('Image After',g)
# cv.waitKey(0)
# cv.destroyAllWindows()
```

Out[8]:
```
<matplotlib.image.AxesImage at 0x2855fec0be0>
```


17500
15000
12500
10000
7500
5000
2500
0
0
50
100
150
200
250


17500
15000
12500
10000
7500
5000
2500
0
0
50
100
150
200
250


0
100
200
300
400
0
100
200
300
400

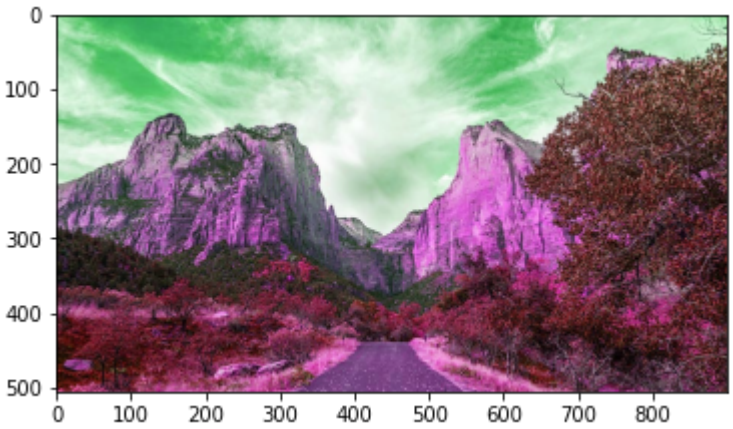


In [9]:
```
img = cv.imread('zion_pass.jpg', cv.IMREAD_COLOR).astype(np.float32) / 255.0
hlsImg = cv.cvtColor(img, cv.COLOR_BGR2HLS)
hlsImg[:, :, 2] = (1.0 + 50 / float(100)) * hlsImg[:, :, 2]
hlsImg[:, :, 2][hlsImg[:, :, 2] > 1] = 1
outImg = cv.cvtColor(hlsImg, cv.COLOR_HLS2RGB) * 255
outImg = outImg.astype(np.uint8)
nimg = cv.cvtColor(img,cv.COLOR_BGR2RGB)
fig1,ax1 = plt.subplots()
ax1.imshow(nimg)
# fig2,ax2 = plt.subplots()
# ax2.plot(t)
fig3,ax3 = plt.subplots()
ax3.imshow(outImg)
```

Out[9]:
```
<matplotlib.image.AxesImage at 0x2855edcf3d0>
```

In [14]:
```
img = cv.imread('zion_pass.jpg', cv.IMREAD_COLOR).astype(np.uint8)
hsvimg = cv.cvtColor(img, cv.COLOR_BGR2HSV)

h,s,v = cv.split(hsvimg)


purpleColor = 100
greenColor = 60

diff_color = greenColor - purpleColor

hnew = np.mod(h + diff_color, 180).astype(np.uint8)

# merging h,s,v
hsv_new = cv.merge([hnew,s,v])

# convert back to rgb
rgb_new = cv.cvtColor(hsv_new, cv.COLOR_HSV2RGB)
fig4,ax4 = plt.subplots()
ax4.imshow(rgb_new)
```

Out[14]:
```
<matplotlib.image.AxesImage at 0x2855eb2dcf0>
```



In [ ]:
```
```