In [4]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
```

In [5]:
```
data = pd.read_csv('H:\ML\heart.csv', sep=",")
```

Описание БД

В качестве набора данных используется

Таблица БД

age - возраст

sex - пол

chest pain type (4 values) - тип боли в груди

resting blood pressure - артериальное давление в покое

serum cholesterol - холестерин сыворотки

fasting blood sugar > 120 mg/dl - Уровень сахара в крови натощак

resting electrocardiographic results (values 0,1,2) - результаты электрокардиографии в покое

maximum heart rate achieved - достигнута максимальная частота сердечных сокращений

exercise induced angina - стенокардия, вызванная физической нагрузкой

oldpeak - депрессия ST, вызванная упражнениями по сравнению с отдыхом

the slope of the peak exercise ST segment - наклон сегмента ST при пиковой нагрузке

number of major vessels (0-3) colored by flourosopy - количество крупных сосудов (0-3), окрашенных флурозолией

thal - максимальная достигнутая частота сердечных сокращений 3 - нормальный; 6 = исправленный дефект; 7 = обратимый дефект

In [6]:
```
data.head()
```

Out[6]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2	1
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2	1
3	56	1	1	120	236	0	1	178	0	0.8	2	0	2	1
4	57	0	0	120	354	0	1	163	1	0.6	2	0	2	1

In [7]:
```
data.shape
```

Out[7]:
```
(303, 14)
```

In [8]:
```
total_count = data.shape[0]
print('Всего строк: {}'.format(total_count))
```

```
Всего строк: 303
```

In [9]:
```
data.columns
```

Out[9]:
```
Index(['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach',
       'exang', 'oldpeak', 'slope', 'ca', 'thal', 'target'],
      dtype='object')
```

In [10]:
```
data.dtypes
```

Out[10]:
```
age         int64
sex         int64
cp          int64
trestbps    int64
chol        int64
fbs         int64
restecg     int64
thalach     int64
exang       int64
oldpeak   float64
slope       int64
ca          int64
thal        int64
target      int64
dtype: object
```

In [11]:
```
for col in data.columns:
    # Количество пустых значений - все значения делим на кол-во строк
    temp_null_count = data[data[col].isnull()].shape[0]
    print('{} - {}'.format(col, temp_null_count))
```

```
age - 0
sex - 0
cp - 0
trestbps - 0
chol - 0
fbs - 0
restecg - 0
thalach - 0
exang - 0
oldpeak - 0
slope - 0
ca - 0
thal - 0
target - 0
```

In [12]:
```
data.describe()
```

Out[12]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000
mean	54.366337	0.683168	0.966997	131.623762	246.264026	0.148515	0.528053	149.646865	0.326733	1.039604	1.399340	0.729373	2.313531	0.544554
std	9.082101	0.466011	1.032052	17.538143	51.830751	0.356198	0.525860	22.905161	0.469794	1.161075	0.616226	1.022606	0.612277	0.498835
min	29.000000	0.000000	0.000000	94.000000	126.000000	0.000000	0.000000	71.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	47.500000	0.000000	0.000000	120.000000	211.000000	0.000000	0.000000	133.500000	0.000000	0.000000	1.000000	0.000000	2.000000	0.000000
50%	55.000000	1.000000	1.000000	130.000000	240.000000	0.000000	1.000000	153.000000	0.000000	0.800000	1.000000	0.000000	2.000000	1.000000
75%	61.000000	1.000000	2.000000	140.000000	274.500000	0.000000	1.000000	166.000000	1.000000	1.600000	2.000000	1.000000	3.000000	1.000000
max	77.000000	1.000000	3.000000	200.000000	564.000000	1.000000	2.000000	202.000000	1.000000	6.200000	2.000000	4.000000	3.000000	1.000000

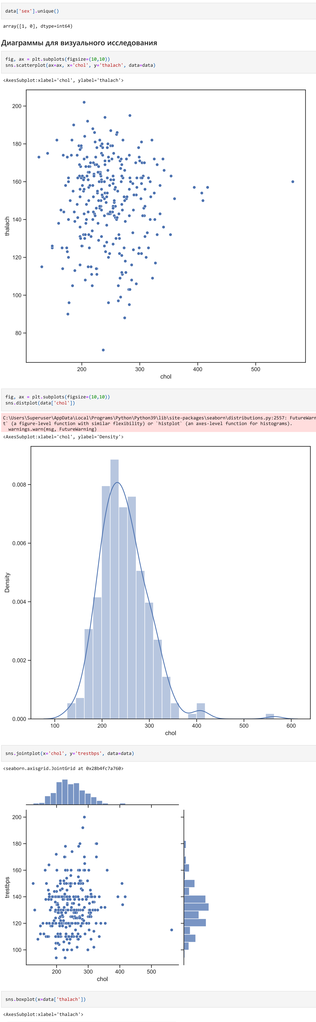
In [14]:
```
data['sex'].unique()
```

Out[14]:
```
array([1, 0], dtype=int64)
```

Диаграммы для визуального исследования

In [27]:
```
fig, ax = plt.subplots(figsize=(10,10))
sns.scatterplot(ax=ax, x='chol', y='thalach', data=data)
```

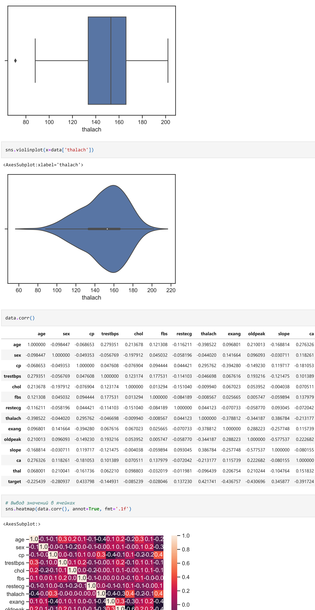
Out[27]:
```
<AxesSubplot:xlabel='chol', ylabel='thalach'>
```



In [33]:
```
fig, ax = plt.subplots(figsize=(10,10))
sns.distplot(data['chol'])
```

```
C:\Users\Superuser\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displo
t` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[33]:
```
<AxesSubplot:xlabel='chol', ylabel='Density'>
```



In [34]:
```
sns.jointplot(x='chol', y='trestbps', data=data)
```

Out[34]:
```
<seaborn.axisgrid.JointGrid at 0x2B04fc7a760>
```

In [35]:
```
sns.boxplot(x=data['thalach'])
```

Out[35]:
```
<AxesSubplot:xlabel='thalach'>
```


In [36]:
```
sns.violinplot(x=data['thalach'])
```

Out[36]:
```
<AxesSubplot:xlabel='thalach'>
```


In [28]:
```
data.corr()
```

Out[28]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
age	1.000000	-0.098447	0.060653	0.279351	0.213678	0.121308	-0.116211	-0.398522	0.096801	0.210013	-0.168814	0.276326	0.068001	-0.225439
sex	-0.098447	1.000000	-0.049353	-0.056769	-0.197912	0.045032	-0.058196	-0.044020	0.141664	0.096093	-0.030711	0.118261	0.210041	-0.280937
cp	0.060653	-0.049353	1.000000	0.047608	-0.076904	0.094444	0.044421	0.295762	-0.394280	-0.149230	0.119717	-0.181053	-0.161736	0.433798
trestbps	0.279351	-0.056769	0.047608	1.000000	0.123174	0.177531	-0.114103	-0.046698	0.067616	0.193216	-0.121475	0.101389	0.062210	-0.144931
chol	0.213678	-0.197912	-0.076904	0.123174	1.000000	0.013294	-0.151040	-0.009940	0.067023	0.053952	-0.004038	0.070511	0.098803	-0.085239
fbs	0.121308	0.045032	0.094444	0.177531	0.013294	1.000000	-0.084189	-0.008567	0.025665	0.005747	-0.059894	0.137979	-0.032019	-0.028046
restecg	-0.116211	-0.058196	0.044421	-0.114103	-0.151040	-0.084189	1.000000	0.044123	-0.070733	-0.058770	0.093045	-0.072042	-0.011981	0.137230
thalach	-0.398522	-0.044020	0.295762	-0.046698	-0.009940	-0.008567	0.044123	1.000000	-0.378812	-0.344187	0.386784	-0.213177	-0.096439	0.421741
exang	0.096801	0.141664	-0.394280	0.067616	0.067023	0.025665	-0.070733	-0.378812	1.000000	0.288223	-0.257748	0.115739	0.206754	-0.436757
oldpeak	0.210013	0.096093	-0.149230	0.193216	0.053952	0.005747	-0.058770	-0.344187	0.288223	1.000000	-0.577537	0.222682	0.210244	-0.430696
slope	-0.168814	-0.030711	0.119717	-0.121475	-0.004038	-0.059894	0.093045	0.386784	-0.257748	-0.577537	1.000000	-0.080155	-0.104764	0.345877
ca	0.276326	0.118261	-0.181053	0.101389	0.070511	0.137979	-0.072042	-0.213177	0.115739	0.222682	-0.080155	1.000000	0.151832	-0.391724
thal	0.068001	0.210041	-0.161736	0.062210	0.098803	-0.032019	-0.011981	-0.096439	0.206754	0.210244	-0.104764	0.151832	1.000000	-0.344029
target	-0.225439	-0.280937	0.433798	-0.144931	-0.085239	-0.028046	0.137230	0.421741	-0.436757	-0.430696	0.345877	-0.391724	-0.344029	1.000000

In [38]:
```
# Выбор значений 0 очевидно
sns.heatmap(data.corr(), annot=True, fmt='.1f')
```

Out[38]:
```
<AxesSubplot:>
```


In [ ]:
```

```