main

March 30, 2023

1 Extract male bias genes on the X chromosome

[1]:
```
import session_info
import pandas as pd
from pyhere import here
```

[2]:
```
def get_deg():
    fn = here("differential_expression/tissue_comparison/summary_table",
              "_m/differential_expression_analysis_4features_sex.txt.gz")
    df = pd.read_csv(fn, sep='\t').loc[:, ["Tissue", "Feature", "ensemblID",␣
 ↪"Symbol",
                                           "seqnames", "Type", "t",␣
 ↪"Chrom_Type", "adj.P.Val"]]
    return df[(df["Type"] == "Gene") & (df["adj.P.Val"] < 0.05)].copy()
```

[3]:
```
df = get_deg()
```

[4]:
```
xci = pd.read_csv("../../_h/xci_status_hg19.txt", sep='\t')
xci["ensemblID"] = xci["Gene ID"].str.replace("\\..*", "", regex=True)
xci.head(2)
```

[4]:
```
  Gene name            Gene ID Chr  Start position  End position  \
0    PLCXD1  ENSG00000182378.8   X          192989        220023
1    GTPBP6  ENSG00000178605.8   X          220025        230886

  Transcript type Combined XCI status        ensemblID
0  protein_coding              escape  ENSG00000182378
1  protein_coding              escape  ENSG00000178605
```

[5]:
```
xci.groupby("Combined XCI status").size()
```

[5]:
```
Combined XCI status
escape       99
inactive    431
variable    101
dtype: int64
```

[6]:
```
tt = df.merge(xci[(xci["Combined XCI status"] == "escape")], on="ensemblID")
tt[(tt['t'] > 0)]
```

[6]:

	Tissue	Feature	ensemblID	Symbol	\
26	Caudate	CD99|ENSG00000002586.20	ENSG00000002586	CD99	
27	DLPFC	CD99|ENSG00000002586.20	ENSG00000002586	CD99	
28	Hippocampus	CD99|ENSG00000002586.20	ENSG00000002586	CD99	
34	Caudate	ZBED1|ENSG00000214717.12	ENSG00000214717	ZBED1	
35	DLPFC	ZBED1|ENSG00000214717.12	ENSG00000214717	ZBED1	
36	Hippocampus	ZBED1|ENSG00000214717.12	ENSG00000214717	ZBED1	
37	Caudate	DHRSX|ENSG00000169084.15	ENSG00000169084	DHRSX	
38	DLPFC	DHRSX|ENSG00000169084.15	ENSG00000169084	DHRSX	
39	Hippocampus	DHRSX|ENSG00000169084.15	ENSG00000169084	DHRSX	
46	Caudate	PLCXD1|ENSG00000182378.15	ENSG00000182378	PLCXD1	
47	DLPFC	PLCXD1|ENSG00000182378.15	ENSG00000182378	PLCXD1	
48	Hippocampus	PLCXD1|ENSG00000182378.15	ENSG00000182378	PLCXD1	
54	Caudate	GTPBP6|ENSG00000178605.14	ENSG00000178605	GTPBP6	
55	DLPFC	GTPBP6|ENSG00000178605.14	ENSG00000178605	GTPBP6	
56	Hippocampus	GTPBP6|ENSG00000178605.14	ENSG00000178605	GTPBP6	
61	Caudate	ASMTL|ENSG00000169093.16	ENSG00000169093	ASMTL	
62	DLPFC	ASMTL|ENSG00000169093.16	ENSG00000169093	ASMTL	
63	Hippocampus	ASMTL|ENSG00000169093.16	ENSG00000169093	ASMTL	
64	Caudate	PPP2R3B|ENSG00000167393.18	ENSG00000167393	PPP2R3B	
65	DLPFC	PPP2R3B|ENSG00000167393.18	ENSG00000167393	PPP2R3B	
66	Hippocampus	PPP2R3B|ENSG00000167393.18	ENSG00000167393	PPP2R3B	
69	Caudate	CD99P1|ENSG00000223773.9	ENSG00000223773	CD99P1	
70	DLPFC	CD99P1|ENSG00000223773.9	ENSG00000223773	CD99P1	
71	Hippocampus	CD99P1|ENSG00000223773.9	ENSG00000223773	CD99P1	
79	Caudate	IL3RA|ENSG00000185291.12	ENSG00000185291	IL3RA	
82	Caudate	ASMTL-AS1|ENSG00000236017.8	ENSG00000236017	ASMTL-AS1	
85	Caudate	LINC00106|ENSG00000236871.7	ENSG00000236871	LINC00106	
87	Hippocampus	AKAP17A|ENSG00000197976.12	ENSG00000197976	AKAP17A	

	seqnames	Type	t	Chrom_Type	adj.P.Val	Gene name	\
26	chrX	Gene	20.718194	Allosome	9.927600e-62	CD99	
27	chrX	Gene	10.690853	Allosome	1.487166e-20	CD99	
28	chrX	Gene	10.917016	Allosome	1.493665e-21	CD99	
34	chrX	Gene	14.600959	Allosome	4.860361e-36	ZBED1	
35	chrX	Gene	6.980985	Allosome	5.207188e-09	ZBED1	
36	chrX	Gene	13.595283	Allosome	1.234819e-31	ZBED1	
37	chrX	Gene	13.689327	Allosome	2.277083e-32	DHRSX	
38	chrX	Gene	7.063517	Allosome	3.144477e-09	DHRSX	
39	chrX	Gene	10.147705	Allosome	7.500811e-19	DHRSX	
46	chrX	Gene	11.285881	Allosome	4.067496e-23	PLCXD1	
47	chrX	Gene	8.640379	Allosome	8.799965e-14	PLCXD1	
48	chrX	Gene	8.739616	Allosome	3.292915e-14	PLCXD1	
54	chrX	Gene	10.387204	Allosome	6.926781e-20	GTPBP6	

55	chrX	Gene	7.267410	Allosome	9.077018e-10	GTPBP6
56	chrX	Gene	8.947148	Allosome	7.560856e-15	GTPBP6
61	chrX	Gene	7.896321	Allosome	9.027584e-12	ASMTL
62	chrX	Gene	8.213591	Allosome	1.762084e-12	ASMTL
63	chrX	Gene	9.253175	Allosome	7.723961e-16	ASMTL
64	chrX	Gene	7.727152	Allosome	2.781165e-11	PPP2R3B
65	chrX	Gene	4.258662	Allosome	5.423498e-03	PPP2R3B
66	chrX	Gene	8.034230	Allosome	4.626593e-12	PPP2R3B
69	chrX	Gene	6.853646	Allosome	7.729268e-09	CD99P1
70	chrX	Gene	6.564555	Allosome	6.221642e-08	CD99P1
71	chrX	Gene	7.829146	Allosome	1.868196e-11	CD99P1
79	chrX	Gene	4.012975	Allosome	6.880722e-03	IL3RA
82	chrX	Gene	3.413658	Allosome	3.552684e-02	ASMTL-AS1
85	chrX	Gene	3.300754	Allosome	4.480663e-02	LINC00106
87	chrX	Gene	4.214142	Allosome	6.764315e-03	AKAP17A

	Gene ID	Chr	Start position	End position	Transcript type	\
26	ENSG00000002586.13	X	2609220	2659350	protein_coding	
27	ENSG00000002586.13	X	2609220	2659350	protein_coding	
28	ENSG00000002586.13	X	2609220	2659350	protein_coding	
34	ENSG00000214717.5	X	2404455	2419008	protein_coding	
35	ENSG00000214717.5	X	2404455	2419008	protein_coding	
36	ENSG00000214717.5	X	2404455	2419008	protein_coding	
37	ENSG00000169084.8	X	2137557	2420846	protein_coding	
38	ENSG00000169084.8	X	2137557	2420846	protein_coding	
39	ENSG00000169084.8	X	2137557	2420846	protein_coding	
46	ENSG00000182378.8	X	192989	220023	protein_coding	
47	ENSG00000182378.8	X	192989	220023	protein_coding	
48	ENSG00000182378.8	X	192989	220023	protein_coding	
54	ENSG00000178605.8	X	220025	230886	protein_coding	
55	ENSG00000178605.8	X	220025	230886	protein_coding	
56	ENSG00000178605.8	X	220025	230886	protein_coding	
61	ENSG00000169093.10	X	1522032	1572655	protein_coding	
62	ENSG00000169093.10	X	1522032	1572655	protein_coding	
63	ENSG00000169093.10	X	1522032	1572655	protein_coding	
64	ENSG00000167393.12	X	294698	347690	protein_coding	
65	ENSG00000167393.12	X	294698	347690	protein_coding	
66	ENSG00000167393.12	X	294698	347690	protein_coding	
69	ENSG00000223773.2	X	2527389	2575270	pseudogene	
70	ENSG00000223773.2	X	2527389	2575270	pseudogene	
71	ENSG00000223773.2	X	2527389	2575270	pseudogene	
79	ENSG00000185291.6	X	1455509	1501578	protein_coding	
82	ENSG00000236017.3	X	1520662	1532921	antisense	
85	ENSG00000236871.2	X	1515320	1518295	lincRNA	
87	ENSG00000197976.6	X	1710486	1721407	protein_coding	

Combined XCI status

```
26              escape
27              escape
28              escape
34              escape
35              escape
36              escape
37              escape
38              escape
39              escape
46              escape
47              escape
48              escape
54              escape
55              escape
56              escape
61              escape
62              escape
63              escape
64              escape
65              escape
66              escape
69              escape
70              escape
71              escape
79              escape
82              escape
85              escape
87              escape
```

Escaped genes are also located on the PAR regions of the Y chromosome.

[7]:
```
xlinked = df[(df['seqnames'] == 'chrX')].copy()
xx_male = df[(df['seqnames'].isin(["chrX", "chrY"])) & (df["t"] > 0)].copy()
xlinked_male = xlinked[(xlinked["t"] > 0)].copy()
xlinked_female = xlinked[(xlinked["t"] < 0)].copy()
```

[8]:
```
xlinked.groupby("Tissue").size()
```

[8]:
```
Tissue
Caudate        72
DLPFC          36
Hippocampus    44
dtype: int64
```

[9]:
```
xlinked_male.groupby("Tissue").size()
```

[9]:
```
Tissue
Caudate        22
```

```
DLPFC          14
Hippocampus    13
dtype: int64
```

[10]:
```
xlinked_female.groupby("Tissue").size()
```

[10]:
```
Tissue
Caudate        50
DLPFC          22
Hippocampus    31
dtype: int64
```

[11]:
```
xlinked_male
```

[11]:

	Tissue	Feature	ensemblID	\
53	Caudate	CD99|ENSG00000002586.20	ENSG00000002586	
56	Caudate	PRKCIP1|ENSG00000237682.2	ENSG00000237682	
62	Caudate	ZBED1|ENSG00000214717.12	ENSG00000214717	
65	Caudate	DHRSX|ENSG00000169084.15	ENSG00000169084	
66	Caudate	ENSG00000289007|ENSG00000289007.2	ENSG00000289007	
72	Caudate	PLCXD1|ENSG00000182378.15	ENSG00000182378	
77	Caudate	GTPBP6|ENSG00000178605.14	ENSG00000178605	
91	Caudate	ASMTL|ENSG00000169093.16	ENSG00000169093	
94	Caudate	PPP2R3B|ENSG00000167393.18	ENSG00000167393	
100	Caudate	CD99P1|ENSG00000223773.9	ENSG00000223773	
107	Caudate	LINC00685|ENSG00000226179.6	ENSG00000226179	
140	Caudate	CACNA1F|ENSG00000102001.13	ENSG00000102001	
167	Caudate	FIRRE|ENSG00000213468.7	ENSG00000213468	
176	Caudate	MAGEE2|ENSG00000186675.7	ENSG00000186675	
281	Caudate	IL3RA|ENSG00000185291.12	ENSG00000185291	
434	Caudate	REPS2|ENSG00000169891.18	ENSG00000169891	
457	Caudate	ENSG00000235189|ENSG00000235189.2	ENSG00000235189	
529	Caudate	MCTS1|ENSG00000232119.8	ENSG00000232119	
536	Caudate	ASMTL-AS1|ENSG00000236017.8	ENSG00000236017	
557	Caudate	ENSG00000286085|ENSG00000286085.1	ENSG00000286085	
614	Caudate	ARHGEF9|ENSG00000131089.17	ENSG00000131089	
632	Caudate	LINC00106|ENSG00000236871.7	ENSG00000236871	
681463	DLPFC	PRKCIP1|ENSG00000237682.2	ENSG00000237682	
681470	DLPFC	ENSG00000289007|ENSG00000289007.2	ENSG00000289007	
681473	DLPFC	CD99|ENSG00000002586.20	ENSG00000002586	
681483	DLPFC	PLCXD1|ENSG00000182378.15	ENSG00000182378	
681485	DLPFC	ASMTL|ENSG00000169093.16	ENSG00000169093	
681492	DLPFC	GTPBP6|ENSG00000178605.14	ENSG00000178605	
681496	DLPFC	DHRSX|ENSG00000169084.15	ENSG00000169084	
681497	DLPFC	ZBED1|ENSG00000214717.12	ENSG00000214717	
681502	DLPFC	CD99P1|ENSG00000223773.9	ENSG00000223773	
681551	DLPFC	PPP2R3B|ENSG00000167393.18	ENSG00000167393	

681558	DLPFC	LINC00685|ENSG00000226179.6	ENSG00000226179
681571	DLPFC	NLRP3P1|ENSG00000277883.1	ENSG00000277883
681610	DLPFC	ENSG00000236064|ENSG00000236064.3	ENSG00000236064
681654	DLPFC	CHMP1B2P|ENSG00000278530.5	ENSG00000278530
1333417	Hippocampus	PRKCIP1|ENSG00000237682.2	ENSG00000237682
1333426	Hippocampus	ZBED1|ENSG00000214717.12	ENSG00000214717
1333434	Hippocampus	CD99|ENSG00000002586.20	ENSG00000002586
1333435	Hippocampus	ENSG00000289007|ENSG00000289007.2	ENSG00000289007
1333437	Hippocampus	DHRSX|ENSG00000169084.15	ENSG00000169084
1333439	Hippocampus	ASMTL|ENSG00000169093.16	ENSG00000169093
1333440	Hippocampus	GTPBP6|ENSG00000178605.14	ENSG00000178605
1333444	Hippocampus	PLCXD1|ENSG00000182378.15	ENSG00000182378
1333450	Hippocampus	PPP2R3B|ENSG00000167393.18	ENSG00000167393
1333451	Hippocampus	CD99P1|ENSG00000223773.9	ENSG00000223773
1333488	Hippocampus	LINC00685|ENSG00000226179.6	ENSG00000226179
1333499	Hippocampus	AKAP17A|ENSG00000197976.12	ENSG00000197976
1333516	Hippocampus	ZNF41|ENSG00000147124.13	ENSG00000147124

	Symbol	seqnames	Type	t	Chrom_Type	adj.P.Val
53	CD99	chrX	Gene	20.718194	Allosome	9.927600e-62
56	PRKCIP1	chrX	Gene	17.897618	Allosome	9.042191e-50
62	ZBED1	chrX	Gene	14.600959	Allosome	4.860361e-36
65	DHRSX	chrX	Gene	13.689327	Allosome	2.277083e-32
66	ENSG00000289007	chrX	Gene	12.947296	Allosome	1.978779e-29
72	PLCXD1	chrX	Gene	11.285881	Allosome	4.067496e-23
77	GTPBP6	chrX	Gene	10.387204	Allosome	6.926781e-20
91	ASMTL	chrX	Gene	7.896321	Allosome	9.027584e-12
94	PPP2R3B	chrX	Gene	7.727152	Allosome	2.781165e-11
100	CD99P1	chrX	Gene	6.853646	Allosome	7.729268e-09
107	LINC00685	chrX	Gene	6.393728	Allosome	1.178363e-07
140	CACNA1F	chrX	Gene	5.287079	Allosome	3.998273e-05
167	FIRRE	chrX	Gene	4.844137	Allosome	2.963626e-04
176	MAGEE2	chrX	Gene	4.617251	Allosome	8.083446e-04
281	IL3RA	chrX	Gene	4.012975	Allosome	6.880722e-03
434	REPS2	chrX	Gene	3.566068	Allosome	2.524039e-02
457	ENSG00000235189	chrX	Gene	3.519369	Allosome	2.835066e-02
529	MCTS1	chrX	Gene	3.418956	Allosome	3.532313e-02
536	ASMTL-AS1	chrX	Gene	3.413658	Allosome	3.552684e-02
557	ENSG00000286085	chrX	Gene	3.383794	Allosome	3.788879e-02
614	ARHGEF9	chrX	Gene	3.323602	Allosome	4.259924e-02
632	LINC00106	chrX	Gene	3.300754	Allosome	4.480663e-02
681463	PRKCIP1	chrX	Gene	23.144727	Allosome	1.157617e-69
681470	ENSG00000289007	chrX	Gene	10.866842	Allosome	3.758222e-21
681473	CD99	chrX	Gene	10.690853	Allosome	1.487166e-20
681483	PLCXD1	chrX	Gene	8.640379	Allosome	8.799965e-14
681485	ASMTL	chrX	Gene	8.213591	Allosome	1.762084e-12
681492	GTPBP6	chrX	Gene	7.267410	Allosome	9.077018e-10

681496	DHRSX	chrX	Gene	7.063517	Allosome	3.144477e-09
681497	ZBED1	chrX	Gene	6.980985	Allosome	5.207188e-09
681502	CD99P1	chrX	Gene	6.564555	Allosome	6.221642e-08
681551	PPP2R3B	chrX	Gene	4.258662	Allosome	5.423498e-03
681558	LINC00685	chrX	Gene	4.176934	Allosome	7.264379e-03
681571	NLRP3P1	chrX	Gene	4.016033	Allosome	1.287122e-02
681610	ENSG00000236064	chrX	Gene	3.745985	Allosome	2.961044e-02
681654	CHMP1B2P	chrX	Gene	3.607484	Allosome	4.049366e-02
1333417	PRKCIP1	chrX	Gene	21.036757	Allosome	3.995345e-62
1333426	ZBED1	chrX	Gene	13.595283	Allosome	1.234819e-31
1333434	CD99	chrX	Gene	10.917016	Allosome	1.493665e-21
1333435	ENSG00000289007	chrX	Gene	10.581601	Allosome	2.325250e-20
1333437	DHRSX	chrX	Gene	10.147705	Allosome	7.500811e-19
1333439	ASMTL	chrX	Gene	9.253175	Allosome	7.723961e-16
1333440	GTPBP6	chrX	Gene	8.947148	Allosome	7.560856e-15
1333444	PLCXD1	chrX	Gene	8.739616	Allosome	3.292915e-14
1333450	PPP2R3B	chrX	Gene	8.034230	Allosome	4.626593e-12
1333451	CD99P1	chrX	Gene	7.829146	Allosome	1.868196e-11
1333488	LINC00685	chrX	Gene	4.800975	Allosome	5.409422e-04
1333499	AKAP17A	chrX	Gene	4.214142	Allosome	6.764315e-03
1333516	ZNF41	chrX	Gene	3.850933	Allosome	2.614981e-02

[12]:
```
xlinked_male.merge(xci[["ensemblID", "Combined XCI status"]], on="ensemblID",␣
↪how="left").fillna("unknown")
```

[12]:

	Tissue	Feature	ensemblID	\
0	Caudate	CD99|ENSG00000002586.20	ENSG00000002586	
1	Caudate	PRKCIP1|ENSG00000237682.2	ENSG00000237682	
2	Caudate	ZBED1|ENSG00000214717.12	ENSG00000214717	
3	Caudate	DHRSX|ENSG00000169084.15	ENSG00000169084	
4	Caudate	ENSG00000289007|ENSG00000289007.2	ENSG00000289007	
5	Caudate	PLCXD1|ENSG00000182378.15	ENSG00000182378	
6	Caudate	GTPBP6|ENSG00000178605.14	ENSG00000178605	
7	Caudate	ASMTL|ENSG00000169093.16	ENSG00000169093	
8	Caudate	PPP2R3B|ENSG00000167393.18	ENSG00000167393	
9	Caudate	CD99P1|ENSG00000223773.9	ENSG00000223773	
10	Caudate	LINC00685|ENSG00000226179.6	ENSG00000226179	
11	Caudate	CACNA1F|ENSG00000102001.13	ENSG00000102001	
12	Caudate	FIRRE|ENSG00000213468.7	ENSG00000213468	
13	Caudate	MAGEE2|ENSG00000186675.7	ENSG00000186675	
14	Caudate	IL3RA|ENSG00000185291.12	ENSG00000185291	
15	Caudate	REPS2|ENSG00000169891.18	ENSG00000169891	
16	Caudate	ENSG00000235189|ENSG00000235189.2	ENSG00000235189	
17	Caudate	MCTS1|ENSG00000232119.8	ENSG00000232119	
18	Caudate	ASMTL-AS1|ENSG00000236017.8	ENSG00000236017	
19	Caudate	ENSG00000286085|ENSG00000286085.1	ENSG00000286085	
20	Caudate	ARHGEF9|ENSG00000131089.17	ENSG00000131089	

21	Caudate	LINC00106|ENSG00000236871.7	ENSG00000236871
22	DLPFC	PRKCIP1|ENSG00000237682.2	ENSG00000237682
23	DLPFC	ENSG00000289007|ENSG00000289007.2	ENSG00000289007
24	DLPFC	CD99|ENSG00000002586.20	ENSG00000002586
25	DLPFC	PLCXD1|ENSG00000182378.15	ENSG00000182378
26	DLPFC	ASMTL|ENSG00000169093.16	ENSG00000169093
27	DLPFC	GTPBP6|ENSG00000178605.14	ENSG00000178605
28	DLPFC	DHRSX|ENSG00000169084.15	ENSG00000169084
29	DLPFC	ZBED1|ENSG00000214717.12	ENSG00000214717
30	DLPFC	CD99P1|ENSG00000223773.9	ENSG00000223773
31	DLPFC	PPP2R3B|ENSG00000167393.18	ENSG00000167393
32	DLPFC	LINC00685|ENSG00000226179.6	ENSG00000226179
33	DLPFC	NLRP3P1|ENSG00000277883.1	ENSG00000277883
34	DLPFC	ENSG00000236064|ENSG00000236064.3	ENSG00000236064
35	DLPFC	CHMP1B2P|ENSG00000278530.5	ENSG00000278530
36	Hippocampus	PRKCIP1|ENSG00000237682.2	ENSG00000237682
37	Hippocampus	ZBED1|ENSG00000214717.12	ENSG00000214717
38	Hippocampus	CD99|ENSG00000002586.20	ENSG00000002586
39	Hippocampus	ENSG00000289007|ENSG00000289007.2	ENSG00000289007
40	Hippocampus	DHRSX|ENSG00000169084.15	ENSG00000169084
41	Hippocampus	ASMTL|ENSG00000169093.16	ENSG00000169093
42	Hippocampus	GTPBP6|ENSG00000178605.14	ENSG00000178605
43	Hippocampus	PLCXD1|ENSG00000182378.15	ENSG00000182378
44	Hippocampus	PPP2R3B|ENSG00000167393.18	ENSG00000167393
45	Hippocampus	CD99P1|ENSG00000223773.9	ENSG00000223773
46	Hippocampus	LINC00685|ENSG00000226179.6	ENSG00000226179
47	Hippocampus	AKAP17A|ENSG00000197976.12	ENSG00000197976
48	Hippocampus	ZNF41|ENSG00000147124.13	ENSG00000147124

	Symbol	seqnames	Type	t	Chrom_Type	adj.P.Val	\
0	CD99	chrX	Gene	20.718194	Allosome	9.927600e-62	
1	PRKCIP1	chrX	Gene	17.897618	Allosome	9.042191e-50	
2	ZBED1	chrX	Gene	14.600959	Allosome	4.860361e-36	
3	DHRSX	chrX	Gene	13.689327	Allosome	2.277083e-32	
4	ENSG00000289007	chrX	Gene	12.947296	Allosome	1.978779e-29	
5	PLCXD1	chrX	Gene	11.285881	Allosome	4.067496e-23	
6	GTPBP6	chrX	Gene	10.387204	Allosome	6.926781e-20	
7	ASMTL	chrX	Gene	7.896321	Allosome	9.027584e-12	
8	PPP2R3B	chrX	Gene	7.727152	Allosome	2.781165e-11	
9	CD99P1	chrX	Gene	6.853646	Allosome	7.729268e-09	
10	LINC00685	chrX	Gene	6.393728	Allosome	1.178363e-07	
11	CACNA1F	chrX	Gene	5.287079	Allosome	3.998273e-05	
12	FIRRE	chrX	Gene	4.844137	Allosome	2.963626e-04	
13	MAGEE2	chrX	Gene	4.617251	Allosome	8.083446e-04	
14	IL3RA	chrX	Gene	4.012975	Allosome	6.880722e-03	
15	REPS2	chrX	Gene	3.566068	Allosome	2.524039e-02	
16	ENSG00000235189	chrX	Gene	3.519369	Allosome	2.835066e-02	

17	MCTS1	chrX	Gene	3.418956	Allosome	3.532313e-02
18	ASMTL-AS1	chrX	Gene	3.413658	Allosome	3.552684e-02
19	ENSG00000286085	chrX	Gene	3.383794	Allosome	3.788879e-02
20	ARHGEF9	chrX	Gene	3.323602	Allosome	4.259924e-02
21	LINC00106	chrX	Gene	3.300754	Allosome	4.480663e-02
22	PRKCIP1	chrX	Gene	23.144727	Allosome	1.157617e-69
23	ENSG00000289007	chrX	Gene	10.866842	Allosome	3.758222e-21
24	CD99	chrX	Gene	10.690853	Allosome	1.487166e-20
25	PLCXD1	chrX	Gene	8.640379	Allosome	8.799965e-14
26	ASMTL	chrX	Gene	8.213591	Allosome	1.762084e-12
27	GTPBP6	chrX	Gene	7.267410	Allosome	9.077018e-10
28	DHRSX	chrX	Gene	7.063517	Allosome	3.144477e-09
29	ZBED1	chrX	Gene	6.980985	Allosome	5.207188e-09
30	CD99P1	chrX	Gene	6.564555	Allosome	6.221642e-08
31	PPP2R3B	chrX	Gene	4.258662	Allosome	5.423498e-03
32	LINC00685	chrX	Gene	4.176934	Allosome	7.264379e-03
33	NLRP3P1	chrX	Gene	4.016033	Allosome	1.287122e-02
34	ENSG00000236064	chrX	Gene	3.745985	Allosome	2.961044e-02
35	CHMP1B2P	chrX	Gene	3.607484	Allosome	4.049366e-02
36	PRKCIP1	chrX	Gene	21.036757	Allosome	3.995345e-62
37	ZBED1	chrX	Gene	13.595283	Allosome	1.234819e-31
38	CD99	chrX	Gene	10.917016	Allosome	1.493665e-21
39	ENSG00000289007	chrX	Gene	10.581601	Allosome	2.325250e-20
40	DHRSX	chrX	Gene	10.147705	Allosome	7.500811e-19
41	ASMTL	chrX	Gene	9.253175	Allosome	7.723961e-16
42	GTPBP6	chrX	Gene	8.947148	Allosome	7.560856e-15
43	PLCXD1	chrX	Gene	8.739616	Allosome	3.292915e-14
44	PPP2R3B	chrX	Gene	8.034230	Allosome	4.626593e-12
45	CD99P1	chrX	Gene	7.829146	Allosome	1.868196e-11
46	LINC00685	chrX	Gene	4.800975	Allosome	5.409422e-04
47	AKAP17A	chrX	Gene	4.214142	Allosome	6.764315e-03
48	ZNF41	chrX	Gene	3.850933	Allosome	2.614981e-02

	Combined XCI status
0	escape
1	unknown
2	escape
3	escape
4	unknown
5	escape
6	escape
7	escape
8	escape
9	escape
10	unknown
11	inactive
12	variable

```
13              unknown
14               escape
15             inactive
16              unknown
17             inactive
18               escape
19              unknown
20             inactive
21               escape
22              unknown
23              unknown
24               escape
25               escape
26               escape
27               escape
28               escape
29               escape
30               escape
31               escape
32              unknown
33              unknown
34             inactive
35              unknown
36              unknown
37               escape
38               escape
39              unknown
40               escape
41               escape
42               escape
43               escape
44               escape
45               escape
46              unknown
47               escape
48             inactive
```

[13]:
```
dx = xlinked_male.merge(xci[["ensemblID", "Combined XCI status"]],␣
 ↪on="ensemblID", how="left").fillna("unknown")
dx = dx[(dx["Combined XCI status"] == "unknown")].copy()
```

[14]:
```
pd.concat([xx_male.merge(xci[["ensemblID", "Combined XCI status"]],␣
 ↪on="ensemblID"), dx], axis=0)\
  .sort_values(["Tissue",  "Combined XCI status", "seqnames"], ascending=True)\
  .to_csv("BrainSeq_male_biased_genes_XCI_status.tsv", sep='\t', index=False)
```

1.1 Session information

[15]:
```
session_info.show()
```

[15]:
```
<IPython.core.display.HTML object>
```