Analysis involving metadata

Groups for the comparisons:

The groups are compared to answer these questions:
1. which genes are differentially expressed in each phenotype in diseased vs healthy condition,
2. which genes respond differently in two phenotypes

as diff expressed we consider genes with pval<0.05

1. PASI<10, PASI 10-20, PASI >20

	PHvsPTin010	AveExpr	F	P.Value	adj.P.Val
S100A8	599.76474	35.26414254	31.699621	4.969237e-07	2.087079e-05
IL1F6	1874.11930	14.79463134	22.305453	1.429600e-05	3.002161e-04
S100A9	982.77538	0.01340757	20.044220	3.421065e-05	4.789492e-04
PI3	50.04859	NaN	16.719131	1.301851e-04	1.366944e-03
FOXP3	62.54758	105.78488546	13.176935	5.853347e-04	4.916812e-03
CCL2	15.24002	21.30470335	8.919910	4.071889e-03	2.850323e-02
AIM2	17.35743	9.69153897	8.362277	5.319144e-03	3.191486e-02
CCL27	-77.06775	21.52385876	7.479763	8.179419e-03	4.068216e-02
CTLA4	50.16421	0.76571687	7.350738	8.717606e-03	4.068216e-02

2. **Age of disease onset <40 yr, >=40 yr**

- PHvsPTinYoung=PH.young-PT.young

	PHvsPTinyoung	AveExpr	F	P.Value	adj.P.Val
S100A8	812.4534504	0.89599293	142.05511	1.005837e-17	4.224515e-16
S100A9	1306.6274547	14.83906336	98.71439	1.799653e-14	3.779272e-13
PI3	70.7911256	17.93720384	86.70733	2.065191e-13	2.891267e-12
IL1F6	1812.5822915	0.01340757	67.85545	1.473698e-11	1.547383e-10
CCL27	-128.5246821	21.30470335	56.52845	2.626903e-10	2.206599e-09
FOXP3	42.0501378	105.78488546	21.13292	2.143761e-05	1.500633e-04
LCN2	0.1691676	45.37853921	20.51393	2.730752e-05	1.638451e-04
IL26	6.0209818	27.07800242	19.78226	3.645029e-05	1.913640e-04
CCL2	11.3845602	9.69153897	15.49667	2.108331e-04	9.838879e-04
IL8b	0.1929954	3.48180413	11.55219	1.203973e-03	5.056687e-03

- PHvsPTinOld=PH.old-PT.old

	PHvsPTinold	AveExpr	F	P.Value	adj.P.Val
S100A8	915.7619324	0.56928581	67.67937	1.538106e-11	6.460045e-10
IL1F6	2425.7279144	27.07800242	45.57269	5.658575e-09	1.084205e-07
S100A9	1432.8241754	1.69073895	44.51373	7.744322e-09	1.084205e-07
PI3	80.0274565	1.15422508	41.55349	1.894858e-08	1.989601e-07
IL26	12.3318523	0.89599293	31.11925	5.588251e-07	4.694131e-06
FOXP3	81.4544490	14.79463134	29.73621	9.019893e-07	6.313925e-06
IL22RA1	21.5826287	17.93720384	28.57462	1.356673e-06	8.140039e-06
IFNGR	0.9755615	0.01340757	24.21349	6.622154e-06	3.476631e-05
IFIH1	25.7135583	NaN	22.91189	1.081450e-05	5.046765e-05
CCL27	-132.5437309	21.52385876	22.54466	1.243855e-05	5.224191e-05

- Difold_young =(PH.old-PT.old)-(PH.young-PT.young)

	Difold_young	AveExpr	F	P.Value	adj.P.Val
IL22RA1	16.519608	21.523859	12.174989	0.0008945397	0.02371349
IFIH1	21.507048	9.691539	11.657235	0.0011292139	0.02371349

IFNGR   0.718249 21.304703 9.545432 0.0029930741 0.04190304

3.   Duration of psoriasis <5yr, 5-15yr, >15yr
4.   Nail involvment

- PHvsPTinNO=PH.no-PT.no

	PHvsPTinNO	AveExpr	F	P.Value	adj.P.Val
S100A8	911.6825	0.7657169	67.585898	1.573199e-11	6.607438e-10
S100A9	1282.9677	105.7848855	33.295342	2.671376e-07	5.609890e-06
PI3	64.8429	21.5238588	24.522803	5.900534e-06	8.260747e-05
CCL27	-106.9193	9.6915390	13.278952	5.482866e-04	5.757009e-03
IL1F6	1097.7748	21.3047033	8.991262	3.893127e-03	3.270227e-02

- PHvsPTinYES=PH.yes-PT.yes

	PHvsPTinYES	AveExpr	F	P.Value	adj.P.Val
S100A8	817.8912063	7.7654150	169.98474	1.809080e-19	7.598138e-18
IL1F6	2262.0531088	0.8959929	119.30256	4.092333e-16	8.593899e-15
S100A9	1359.6293915	18.8128644	116.85388	6.269346e-16	8.777085e-15
PI3	76.0196366	97.7777108	105.32873	5.070432e-15	5.323953e-14
CCL27	-136.8852532	0.7657169	68.01657	1.416954e-11	1.190241e-10
FOXP3	65.6931850	35.2641425	57.81948	1.865202e-10	1.305641e-09
IL26	9.2715060	1.6907389	42.03802	1.633586e-08	9.801513e-08
LCN2	0.2059296	1199.1821545	31.87661	4.313154e-07	2.264406e-06
CTLA4	49.0885515	14.7946313	27.42994	2.039794e-06	9.519037e-06
CCL2	14.0433715	21.5238588	23.37092	9.087711e-06	3.816839e-05

- Difyes_no =(PH.yes-PT.yes)-(PH.no-PT.no)- no genes behave differently

5. **Psoriatic arthritis**

- PHvsPTinNO=PH.no-PT.no

	PHvsPTinNO	AveExpr	F	P.Value	adj.P.Val
S100A8	810.0380642	14.83906336	138.28521	1.803917e-17	7.576451e-16
S100A9	1302.2340509	1.15422508	96.03219	3.053033e-14	6.411369e-13
PI3	70.6018825	17.93720384	84.43945	3.348132e-13	4.687385e-12
IL1F6	1804.5186726	0.01340757	65.86115	2.400542e-11	2.520569e-10
CCL27	-129.8099798	21.30470335	56.54436	2.615588e-10	2.197094e-09
FOXP3	42.5209063	105.78488546	21.18581	2.100051e-05	1.470035e-04
IL26	6.1016356	27.07800242	19.93525	3.430533e-05	1.869160e-04
LCN2	0.1684011	45.37853921	19.84152	3.560305e-05	1.869160e-04
CCL2	11.3392912	9.69153897	14.99230	2.612164e-04	1.219010e-03
CTLA4	31.5005172	21.52385876	11.36429	1.289599e-03	5.293176e-03

- PHvsPTinYES=PH.yes-PT.yes

S100A8	919.571330	0.5692858	71.87592	5.636814e-12	2.367462e-10
IL1F6	2438.601710	3.4818041	48.51053	2.408841e-09	4.942495e-08
S100A9	1437.342385	1.6907389	47.18532	3.530354e-09	4.942495e-08
PI3	80.261896	0.9931512	44.01284	8.993174e-09	9.442833e-08
IL26	12.355200	14.8390634	32.96677	2.982888e-07	2.505626e-06
FOXP3	81.054861	NaN	31.04888	5.724811e-07	4.007368e-06
IL22RA1	21.409106	0.8959929	29.61311	9.415833e-07	5.649500e-06
IFNGR	0.984862	14.8390634	25.97683	3.451998e-06	1.812299e-05
IFIH1	25.924001	35.2641425	24.51469	5.918499e-06	2.761966e-05
CCL27	-130.180181	0.7657169	22.93562	1.071720e-05	4.501225e-05

- Difyes_no =(PH.yes-PT.yes)-(PH.no-PT.no)

```
       Difyes_no   AveExpr        F     P.Value    adj.P.Val
IFIH1   21.6318108  9.691539  12.163314 0.0008992230 0.01894283
IL22RA1 16.2493447 21.523859  12.156332 0.0009020395 0.01894283
IFNGR    0.7230716 21.304703   9.977965 0.0024430403 0.03420256
```

6. **Psoriasis in family**

- PHvsPTinNO=PH.no-PT.no

```
         PHvsPTinNO    AveExpr          F      P.Value     adj.P.Val
S100A8   841.7077724 95.56171010 114.131744 1.014392e-15 4.260445e-14
S100A9  1281.3705221 27.07800242  71.441053 6.244846e-12 1.311418e-10
PI3       68.3870987  0.01340757  60.872558 8.426317e-11 1.179684e-09
CCL27   -137.0505399 21.30470335  49.629511 1.750717e-09 1.838252e-08
IL1F6   1581.4873582 14.79463134  41.831914 1.739797e-08 1.461430e-07
LCN2       0.1514803 35.26414254  12.559076 7.536260e-04 5.275382e-03
IL26       4.4301193         NaN   8.787804 4.291140e-03 2.353716e-02
FOXP3     26.2432856  0.76571687   8.502251 4.923050e-03 2.353716e-02
PYCARD    34.4682417 14.83906336   8.452128 5.043677e-03 2.353716e-02
CCL2       9.1957721  9.69153897   7.911333 6.561019e-03 2.755628e-02
```

- PHvsPTinYES=PH.yes-PT.yes

```
         PHvsPTinYES     AveExpr        F     P.Value    adj.P.Val
S100A8   839.3333533 1.199182e+03 94.57394 4.084918e-14 1.715666e-12
IL1F6   2457.7835852 1.793720e+01 84.19423 3.529065e-13 7.411037e-12
FOXP3     84.6609472 3.526414e+01 73.73650 3.649077e-12 5.108708e-11
S100A9  1412.6538063 9.777771e+01 72.35835 5.032555e-12 5.284183e-11
PI3       79.2177564 6.165292e-01 68.06706 1.399736e-11 1.175778e-10
CTLA4     70.0030351 1.479463e+01 59.69010 1.143500e-10 8.004500e-10
IL26      11.7165391 9.931512e-01 51.22323 1.117678e-09 6.706068e-09
CCL27   -120.7050820 7.657169e-01 32.08103 4.023562e-07 2.112370e-06
IFIH1     21.3644199 1.340757e-02 25.87536 3.582396e-06 1.671785e-05
LCN2       0.2145761 1.690739e+00 21.00037 2.257328e-05 8.217254e-05
```

- Difyes_no =(PH.yes-PT.yes)-(PH.no-PT.no)

```
      Difyes_no  AveExpr        F     P.Value    adj.P.Val
CTLA4  57.30005  9.6915390 21.81409 1.646379e-05 0.0006914791
FOXP3  58.41766 21.3047033 19.14975 4.689906e-05 0.0009848803
IFIH1  20.70264 21.5238588 13.25300 5.545714e-04 0.0077639999
IL26    7.28642  0.7657169 10.80576 1.664674e-03 0.0174790756
```

7. Skin phototype

Only psoriasis data was used for testing(PH and PT).

Test were made to see the difference between gene expression in phototype I, II, III in diseased and healthy skin.

- PHvsPTinI=PH.I-PT.I

	PHvsPTinI	AveExpr	F	P.Value	adj.P.Val
S100A8	1428.9134	21.304703	19.73272	3.866616e-05	0.001469314
PI3	124.5208	9.691539	11.35948	1.313413e-03	0.024954856

- PHvsPTinII=PH.II=PT.II

	PHvsPTinII	AveExpr	F	P.Value	adj.P.Val
S100A8	763.2741356	27.07800242	75.905610	2.875840e-12	1.092819e-10
S100A9	1322.4800071	3.48180413	55.397322	4.243075e-10	7.921406e-09
PI3	73.8173399	14.83906336	53.818177	6.468519e-10	7.921406e-09
IL1F6	2192.1560302	105.78488546	52.878019	8.338322e-10	7.921406e-09
CCL27	-134.5925620	21.30470335	33.701302	2.549402e-07	1.937546e-06
FOXP3	51.7788172	21.52385876	14.711059	3.019313e-04	1.912232e-03
IL1RN	76.3429005	14.79463134	13.585048	4.899780e-04	2.567590e-03
LCN2	0.1900769	0.01340757	13.359279	5.405453e-04	2.567590e-03
IL22RA1	12.9453147	NaN	11.369507	1.307469e-03	5.520424e-03
IL26	6.2854267	35.26414254	9.056899	3.815202e-03	1.449777e-02

- PHvsPTinIII=PH.III-PT.III

	PHvsPTinIII	AveExpr	F	P.Value	adj.P.Val
S100A8	868.4062336	0.8959929	134.73344	5.137214e-17	1.952141e-15
S100A9	1330.2127427	14.8390634	76.85454	2.326384e-12	4.420129e-11
PI3	70.2293468	17.9372038	66.79842	2.384610e-11	3.020506e-10
IL1F6	1866.5392418	14.8390634	52.56822	9.070347e-10	8.616829e-09
CCL27	-125.7338649	21.5238588	40.32978	3.101114e-08	2.356846e-07
IL26	9.1521871	27.0780024	26.33155	3.225986e-06	2.043124e-05
FOXP3	56.0186009	14.7946313	23.61136	8.744001e-06	4.746743e-05
CCL2	15.2499558	21.3047033	20.48338	2.881514e-05	1.368719e-04
IL8b	0.2562819	3.4818041	16.82531	1.287112e-04	5.434475e-04
LCN2	0.1754805	45.3785392	15.61344	2.061840e-04	7.834992e-04

- Difference between I and II
- Difference between I and III
- Difference between II and III
    DifII_I =(PH.II-PT.II)-(PH.I-PT.I),
    DifIII_II=(PH.III-PT.III)-(PH.II-PT.II),
    DiffIII_I=(PH.III-PT.III)-(PH.I-PT.I),
  No genes that respond differently in 3 groups.

According to the test results there is no evidence of skin photo type being involved.

8. **Age of disease onset <40 yr, ?40 yr; psoriasis in family**

- PHvsPTinno.young=PH.no.young-PT.no.young

	PHvsPTin.no.young	AveExpr	F	P.Value	adj.P.Val
S100A8	873.37554	105.7848855	88.852564	2.493164e-13	9.972658e-12
S100A9	1308.11575	14.7946313	51.955914	1.270233e-09	2.540466e-08
PI3	70.18910	21.5238588	45.638011	7.338218e-09	9.784291e-08
CCL27	-147.72948	9.6915390	41.273040	2.633920e-08	2.633920e-07
IL1F6	1472.25476	21.3047033	25.164490	5.234827e-06	4.187862e-05
PYCARD	36.19719	0.7657169	7.723933	7.320460e-03	4.880307e-02

- PHvsPTin.no.old=PH.no.old-PT.no.old

	PHvsPTin.no.old	AveExpr	F	P.Value	adj.P.Val
S100A8	759.3715817	105.7848855	25.834690	4.111692e-06	0.0001644677
S100A9	1211.8329233	14.7946313	17.149631	1.127802e-04	0.0022556047
IL1F6	1865.4921079	21.3047033	15.539451	2.188292e-04	0.0029177230
PI3	63.7019064	0.7657169	14.458356	3.449435e-04	0.0034494350
CCL27	-109.2852832	9.6915390	8.687246	4.600536e-03	0.0368042902
LCN2	0.2344505	21.5238588	8.106608	6.078897e-03	0.0405259791

- PHvsPTin.yes.young=PH.yes.young-PT.yes.young

	PHvsPTin.yes.young	AveExpr	F	P.Value	adj.P.Val
S100A8	801.18462	0.9931512	63.26776	7.024032e-11	2.809613e-09
IL1F6	2329.34280	27.0780024	53.30137	8.861915e-10	1.374740e-08
CTLA4	76.45757	105.7848855	52.73349	1.031055e-09	1.374740e-08
S100A9	1372.58982	0.5692858	48.40314	3.360891e-09	2.755774e-08
FOXP3	82.36421	NaN	48.31474	3.444718e-09	2.755774e-08
PI3	73.32083	1.1542251	42.13970	2.034247e-08	1.356165e-07
IL26	11.29778	17.9372038	32.82074	3.734254e-07	2.133859e-06
CCL27	-110.88266	21.5238588	19.67473	4.123311e-05	2.061656e-04
AIM2	19.25541	9.6915390	18.15406	7.522708e-05	3.343426e-04
CCL2	16.71406	21.3047033	15.11993	2.608380e-04	1.043352e-03

- PHvsPTin.yes.old=PH.yes.old-PT.yes.old

	PHvsPTin.yes.old	AveExpr	F	P.Value	adj.P.Val
IL22RA1	32.03190	0.01340757	35.44221	1.597011e-07	6.388044e-06
S100A8	944.24238	45.37853921	31.95594	4.970439e-07	9.940879e-06
IL1RN	172.57377	35.26414254	29.38423	1.184185e-06	1.578914e-05
IL1F6	2810.99574	NaN	28.22664	1.766257e-06	1.766257e-05
PI3	95.43432	27.07800242	25.96051	3.930372e-06	3.144298e-05
S100A9	1522.82976	17.93720384	21.66516	1.915238e-05	1.194339e-04
FOXP3	90.97699	21.52385876	21.43547	2.090094e-05	1.194339e-04
IFIH1	33.25386	0.76571687	19.16910	5.028133e-05	2.514066e-04
IL26	12.86812	14.83906336	15.48317	2.240300e-04	9.956889e-04
CCL27	-147.71673	9.69153897	12.69720	7.376036e-04	2.950414e-03

- No psoriasis in the family. Dif.no.old_young =(PH.no.old-PT.no.old)-(PH.no.young-PT.no.young)
  No diff. expressed genes between the groups.
- Psoriasis in the family history. Dif.yes.old_young =(PH.yes.old-PT.yes.old)-(PH.yes.young-PT.yes.young)

	Dif.yes.old_young	AveExpr	F	P.Value	adj.P.Val
IL22RA1	22.47368	21.304703	12.79396	0.0007069907	0.02827963
IL1RN	121.12441	9.691539	10.61523	0.0018721144	0.03744229

9. **Age of disease onset <40 yr, ?40 yr; PASI**

- PHvsPTin010young=PH.0_10.young-PT.0_10.young

	PHvsPTin010young	AveExpr	F	P.Value	adj.P.Val
S100A8	1093.08747	21.5238588	63.170574	1.145571e-10	4.467725e-09
S100A9	1550.12993	0.7657169	28.479184	1.895717e-06	3.696649e-05
PI3	85.82393	21.3047033	25.918488	4.579317e-06	5.953112e-05
CCL27	-105.16745	9.6915390	8.878642	4.307079e-03	4.199402e-02

- PHvsPTin010old=PH.0_10.old-PT.0_10.old

	PHvsPTin010old	AveExpr	F	P.Value	adj.P.Val
S100A8	609.3409	9.691539	11.77815	0.001152564	0.04495

- PHvsPTin1020young=PH.10_20.young-PT.10_20.young

	PHvsPTin1020young	AveExpr	F	P.Value	adj.P.Val
S100A8	785.7279858	NaN	65.279892	7.014343e-11	2.735594e-09
CCL27	-161.1555100	9.6915390	41.696940	3.046515e-08	5.940705e-07
S100A9	1280.0927694	35.2641425	38.842236	7.048632e-08	9.163221e-07
PI3	71.2224570	14.7946313	35.699057	1.832639e-07	1.786823e-06
IL1F6	1968.4573941	21.5238588	34.879713	2.364674e-07	1.844446e-06
LCN2	0.1929598	105.7848855	11.387479	1.370043e-03	8.905281e-03
FOXP3	37.2415418	21.3047033	8.937718	4.189272e-03	2.334023e-02
IL26	5.6039564	0.7657169	7.634816	7.797496e-03	3.801279e-02

- PHvsPTin1020old=PH.10_20.old-PT.10_20.old

	PHvsPTin1020old	AveExpr	F	P.Value	adj.P.Val
IL1F6	2604.25596	0.7657169	18.315107	7.647722e-05	0.002212377
FOXP3	94.64407	21.5238588	17.317268	1.134552e-04	0.002212377
S100A9	1474.13359	NaN	15.453123	2.413075e-04	0.003136997
S100A8	664.13161	14.7946313	13.991508	4.437141e-04	0.004326212
CTLA4	69.61406	21.3047033	12.826992	7.294720e-04	0.005689882
PI3	76.30999	105.7848855	12.294387	9.191183e-04	0.005974269
CCL27	-129.82724	9.6915390	8.118331	6.176938e-03	0.034414370

- PHvsPTin20Infyoung=PH.20_Inf.young-PT.20_Inf.young

	PHvsPTin20Infyoung	AveExpr	F	P.Value	adj.P.Val
S100A8	878.84956	0.9931512	73.50326	1.123750e-11	4.382624e-10
CTLA4	81.37172	105.7848855	52.57741	1.556196e-09	3.034582e-08
IL1F6	2307.08451	27.0780024	43.12115	2.024311e-08	2.631604e-07
FOXP3	82.98732	NaN	39.94269	5.085105e-08	4.957978e-07
S100A9	1346.91890	0.5692858	38.70319	7.347642e-08	5.731161e-07
PI3	76.52512	1.1542251	37.09141	1.195075e-07	7.767987e-07
IL26	12.73347	17.9372038	35.47684	1.963328e-07	1.093854e-06
IL22RA1	12.22396	45.3785392	20.29054	3.567526e-05	1.739169e-04
AIM2	20.13641	9.6915390	15.51045	2.356866e-04	1.021308e-03
CCL27	-101.32995	0.7657169	14.83652	3.114035e-04	1.214474e-03

- PHvsPTin20Infold=PH.20_Inf.old-PT.20_Inf.old

	PHvsPTin20Infold	AveExpr	F	P.Value	adj.P.Val
IL22RA1	40.55731	14.7946313	74.453698	9.165151e-12	3.574409e-10
IL1RN	192.58674	105.7848855	32.531755	4.978244e-07	9.707577e-06
S100A8	895.98649	14.8390634	25.465908	5.368924e-06	6.979601e-05
IL1F6	2763.40844	0.7657169	20.622071	3.146132e-05	3.067479e-04
IFIH1	36.99787	21.5238588	18.284876	7.738930e-05	6.036365e-04
PI3	90.20344	35.2641425	17.178701	1.199041e-04	7.036180e-04
S100A9	1548.37874	95.5617101	17.048925	1.262904e-04	7.036180e-04
CCL27	-169.70833	9.6915390	13.872075	4.666920e-04	2.275124e-03
FOXP3	79.69872	21.3047033	12.279913	9.249401e-04	4.008074e-03
IL26	11.55264	NaN	9.734036	2.893479e-03	1.128457e-02

- Dif.0_10 =(PH.0_10.old-PT.0_10.old)-(PH.0_10.young-PT.0_10.young),
  Dif.10_20=(PH.10_20.old-PT.10_20.old)-(PH.10_20.young-PT.10_20.young),
  Diff.20_Inf=(PH.20_Inf.old-PT.20_Inf.old)-(PH.20_Inf.young-PT.20_Inf.young)

	Dif.0_10	Dif.10_20	Diff.20_Inf	AveExpr	F	P.Value	adj.P.Val
IL22RA1	4.720022	-5.654369	28.33334	9.691539	9.665288	3.264986e-05	0.001273344

10. Age of disease onset <40 yr, ?40 yr; nail involvment
11. Age of disease onset <40 yr, ?40 yr; psoriatic arthritis
12. Age of disease onset <40 yr, ?40 yr; psoriasis in family; PASI
13. Age of disease onset <40 yr, ?40 yr; psoriasis in family; nail involvment
14. Age of disease onset <40 yr, ?40 yr; psoriasis in family; psoriatic arthritis
15. Age of disease onset <40 yr, ?40 yr; psoriasis in family; PASI; nail involvment
16. Age of disease onset <40 yr, ?40 yr; psoriasis in family; PASI; psoriatic arthritis
17. Psoriasis in family; PASI
18. Psoriasis in family; nail involvment
19. Psoriasis in family; psoriatic arthritis
20. Psoriasis in family; PASI; nail involvment
21. Psoriasis in family; PASI; psoriatic arthritis
22. PASI; nail involvment
23. PASI; psoriatic arthritis

Analysis

Analysis is in phenoLimma.R

1. Multifactorial analysis using limma
2. Draw violin plots for the interesting resulting genes.

Violin plots for Skin Phototypes using all data.

https://biit.cs.ut.ee/redmine/attachments/download/257/Vioplots_skinphototype.png
pdf [[https://biit.cs.ut.ee/redmine/attachments/download/256/ViolinPlots_skinPhototypes.pdf]]