Fig S1: Density plots of the Pearson correlations of PHBR-I and PHBR-II scores between all patient pairs.

Fig S2: Correlations of PHBR-I scores from different HLA alleles
Fig. S3: Scatterplot of log PHBR-I (A) and log PHBR-II (B) scores for a random set of pairs of germline mutations on the same genes.

Table S1: Number of observations corresponding to each bin in Fig. 1C.

| Bin | N (No Mutation) | N (Mutation) |
|-----|-----------------|--------------|
| 3   | 4008601         | 1311         |
| 4   | 1550068         | 676          |
| 5   | 907929          | 495          |
| 6   | 541030          | 354          |
| 7   | 357591          | 273          |
| 8   | 348384          | 304          |
| 9   | 100837          | 99           |
| 10  | 174154          | 190          |
| 11  | 146640          | 176          |
| 12  | 100804          | 132          |
| 13  | 100793          | 143          |
| 14  | 137430          | 210          |
| 15  | 119093          | 195          |
| 16  | 64120           | 112          |
| 17  | 45795           | 85           |
| 18  | 36632           | 72           |
| 19  | 64099           | 133          |
| 20  | 36624           | 80           |
| 21  | 64085           | 147          |
| 22  | 27462           | 66           |
|   |     |     |
|---|-----|-----|
| 23 | 36612 | 92  |
| 24 | 27456 | 72  |
| 25 | 9151  | 25  |
| 26 | 18300 | 52  |
| 29 | 18294 | 58  |
| 31 | 9145  | 31  |
| 32 | 18288 | 64  |
| 34 | 9142  | 34  |
| 35 | 9141  | 35  |
| 36 | 9140  | 36  |
| 37 | 9139  | 37  |
| 39 | 18274 | 78  |
| 40 | 18272 | 80  |
| 45 | 9131  | 45  |
| 50 | 18252 | 100 |
| 62 | 9114  | 62  |
| 69 | 18214 | 138 |
| 79 | 9097  | 79  |
| 80 | 9096  | 80  |
| 88 | 9088  | 88  |
| 98 | 9078  | 98  |
| 107| 18138 | 214 |
| 115| 9061  | 115 |
| 137| 9039  | 137 |
| 139| 9037  | 139 |
| 170| 9006  | 170 |
| 188| 8988  | 188 |
| 215| 8961  | 215 |
| 217| 8959  | 217 |
| 384| 8792  | 384 |
| 561| 8615  | 561 |