### Supplemental Table 2. Plasmids

| Plasmid name                        | WhiteLab Plasmid # | Gene          | Promoter | Bacterial resistance | Selectable marker | Tag     | Tag Location |
|-------------------------------------|--------------------|---------------|----------|----------------------|-------------------|---------|--------------|
| pDONR Kozak HPV16 E7                | 6487               | HPV16 E7      | N/A      | Spectinomycin        | N/A               | N/A     | N/A          |
| pDONR Kozak HPV18 E7                | 6489               | HPV18 E7      | N/A      | Spectinomycin        | N/A               | N/A     | N/A          |
| MSCV-neo C-HA GFP                   | 8133               | GFP           | MSCV LTR| Ampicillin           | Neomycin          | HA      | C-terminus   |
| MSCV-neo C-HAonly HPV16 E7          | 6990               | HPV16 E7      | MSCV LTR| Ampicillin           | Neomycin          | HA      | C-terminus   |
| MSCV-neo C-HAonly HPV18 E7          | 6991               | HPV18 E7      | MSCV LTR| Ampicillin           | Neomycin          | HA      | C-terminus   |
| MSCV-neo C-HAonly HPV31 E7          | 8382               | ZER1          | MSCV LTR| Ampicillin           | Neomycin          | HA      | C-terminus   |
| MSCV-neo C-HAonly HPV16 E7 E80A/D81A| 8383               | HPV16 E7      | MSCV LTR| Ampicillin           | Neomycin          | HA      | C-terminus   |
| MSCV-neo C-HAonly HPV18 E7 E80A/D81A| 8384               | HPV18 E7      | MSCV LTR| Ampicillin           | Neomycin          | HA      | C-terminus   |
| MSCV-IP N-HA Empty v2              | 7270               | None          | MSCV LTR| Ampicillin           | Puromycin         | N/A     | N/A          |
| MSCV-P C-FlagHA HPV18 E7            | 6640               | HPV18 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16-18 E7 Chimera A| 8235             | HPV16-18 E7   | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16-18 E7 Chimera B| 8236             | HPV16-18 E7   | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16-18 E7 Chimera C| 8237             | HPV16-18 E7   | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16 E7 Mutant 1   | 8304               | HPV16 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16 E7 Mutant 2   | 8305               | HPV16 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16 E7 H73A       | 8309               | HPV16 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV16 E7 E80A/D81A  | 8310               | HPV16 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV18 E7 △DLYC      | 7274               | HPV18 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |
| MSCV-P C-FlagHA HPV18 E7 Q87E/Q88D  | 8384               | HPV18 E7      | MSCV LTR| Ampicillin           | Puromycin         | FlagHA  | C-terminus   |

### Supplemental Table 3. sgRNA sequences from Broad Brunello library

| Plasmid name | WhiteLab Plasmid # | sgRNA sequence from Broad Brunello library | Promoter | Bacterial resistance | Selectable marker |
|--------------|--------------------|------------------------------------------|----------|----------------------|-------------------|
| LentiCRISPR v2 sgNT-1 | 8092 | AGCTCCAGCATGTCCGTTTCTC | U6       | Ampicillin           | Puromycin         |
| LentiCRISPR v2 sgZER1-1 | 8312 | CAGGGACCCAATCAATCATG | U6       | Ampicillin           | Puromycin         |
| LentiCRISPR v2 sgZER1-2 | 8313 | AGGGACGAGAGAAGAGCTCTGC | U6       | Ampicillin           | Puromycin         |
| LentiCRISPR v2 sgPTPN14-3 | 8115 | CCAACTGAGAGGAGAAGAACGGG | U6       | Ampicillin           | Puromycin         |
| LentiCRISPR v2 sgPTPN14-4 | 8116 | TGTGCTTACCGTGGAAAAGA | U6       | Ampicillin           | Puromycin         |