**Supplemental Information**

**Synthesis of SELP-815K-MMPRS:**

Monomer gene segment construction is summarized in Figure 1S. Plasmid pSY1378 (cloning vector) was digested with BanI and dephosphorylated with shrimp alkaline phosphatase (SAP). Plasmid pPT317 containing two copies of SELP-815K monomer gene segment were digested with BanI and separated on a 1% agarose gel. The ~400bp fragment corresponding to SELP-815K monomer gene was purified using the Qiaquick Gel Extraction Kit. SELP-815K monomer gene segments were ligated with linearized, dephosphorylated pSY1378 in a 3:1 ratio overnight at room temperature. The ligation mixture was used to transform MAXefficiency Dh5α *E. coli* and the transformation was plated on chloramphenicol-selective LB agar plates. Cultures were grown overnight and colonies were selected and grown in 4 ml starter cultures in chloramphenicol-selective Terrific Broth overnight at 37°C in a shaking incubator at 240 RPM. DNA was isolated from cultures by Qiaprep Spin Miniprep kit, and screened by digestion with BanI. A positive colony was then grown overnight in a 200 ml chloramphenicol-selective Terrific Broth culture and DNA was then extracted using a Qiagen Maxiprep kit.

Custom oligonucleotides encoding for the matrix-metalloproteinase responsive sequence GPQGIFGQ in addition to XagI-compatible overhangs and 5'phosphorylation were solubilized in annealing buffer composed of 10mM Tris, 50mM NaCl, and 1mM EDTA in 18MΩ deionized water to a concentration of 1mM. The sequence of the oligos is shown in Table 1S. Oligos were mixed in a 1:1 ratio and 50µl of oligo mixture was annealed by heating to 95°C in an aluminum heating block, then allowed to cool to room temperature gradually by switching off the heating block.

Plasmid pSY1378 containing SELP-815K monomer gene segment was digested with XagI and dephosphorylated using SAP. Annealed oligos were ligated with the linearized pSY1378+SELP-815K monomer gene segment in a 5:1 molar ratio overnight at room temperature. This ligation mixture was used to transform MAXefficiency Dh5α *E. coli* and the transformation was plated on chloramphenicol-selective LB agar plates and grown overnight at 37°C. Colonies were grown in 4 ml chloramphenicol-selective overnight Terrific Broth cultures, DNA extracted, and digested with AvaII to identify colonies containing the MMP-responsive insert, which appear as a 311bp fragment in Figure 2S. DNA sequencing was used to confirm correct insertion, after which 200 ml terrific broth cultures were grown and pSY1378 containing SELP-815K-MMPRS monomer gene segment was isolated using a Qiagen Maxiprep kit.

**Construction of the polymer gene segment**

Construction of the polymer gene segment for SELP-815K-MMPRS is shown in Figure 3S. Plasmid pPT317 (expression plasmid) containing SELP-815K dimer was digested with BanI and dephosphorylated using SAP. pSY1378 containing SELP-815K-MMPRS monomer gene segment was digested with BanI. Both digests were separated on a 1% agarose gel. The bands corresponding to the 4000 bp linearized and dephosphorylated pPT317 parental vector and the ~400 bp band corresponding to SELP-815K-MMPRS monomer gene segment were purified. Monomer gene segments and linearized dephosphorylated pPT317 were ligated overnight at room temperature at a 42.5:1 molar ratio, with total DNA content of ~650 ng. The ligation mixture was used to transform MAXefficiency Dh5α *E. coli* and the transformation was plated on kanamycin-selective LB agar plates and grown overnight at 30°C. Colonies were grown in kanamycin-selective Terrific Broth, DNA extracted with Qiagen Minipreps, and screened with a

double digest with NcoI and XcmI. Screening digests were run on 1% agarose and colonies displaying a band at ~2400 bp, corresponding to SELP-815K-MMPRS 6-mer were stocked in 50% glycerol and analyzed for protein production. An example of an agarose gel showing typical results of a multimerization reaction is shown in Figure 4S.

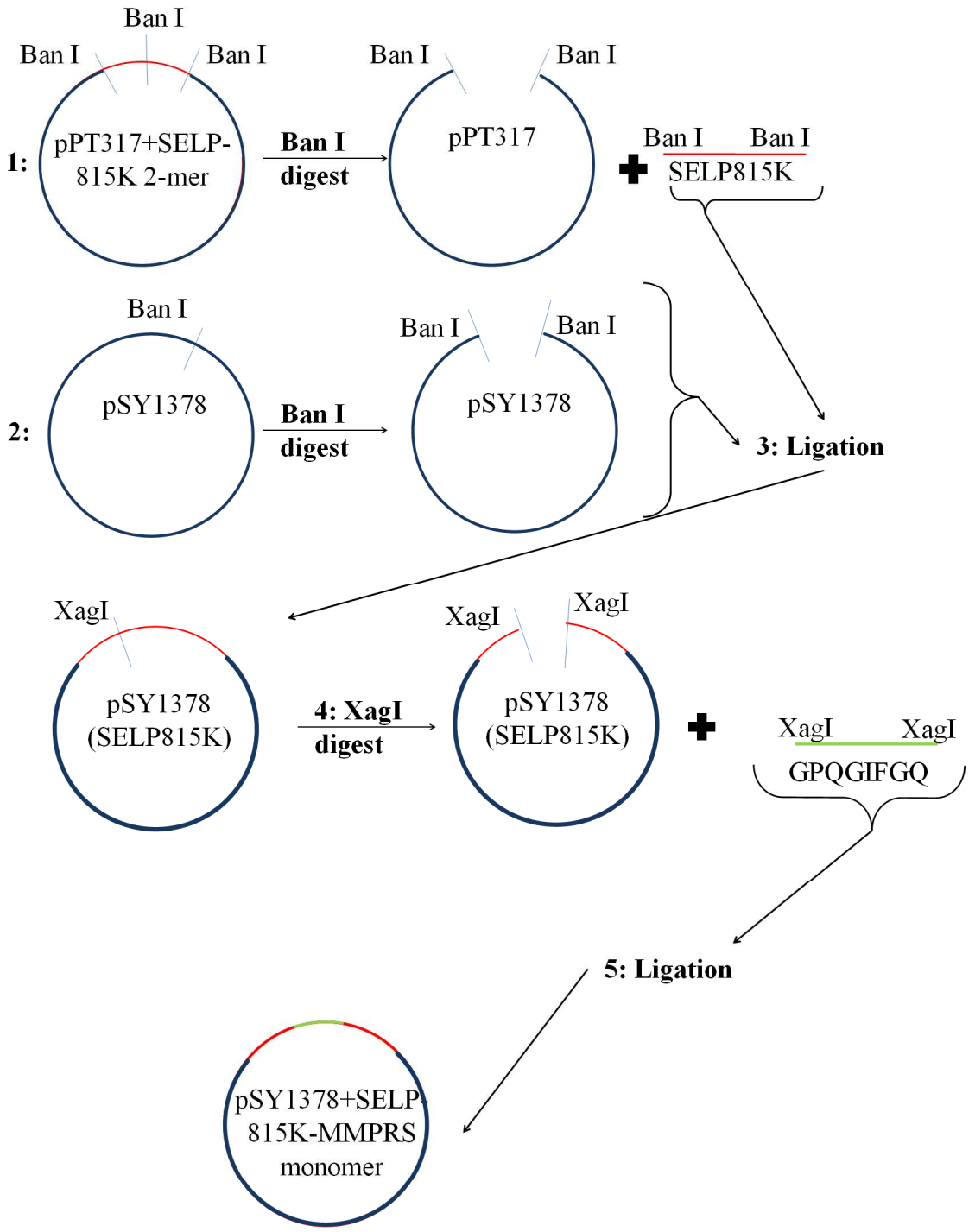


Figure 1S: Synthetic strategy for SELP-815K-MMPRS monomer gene segments.

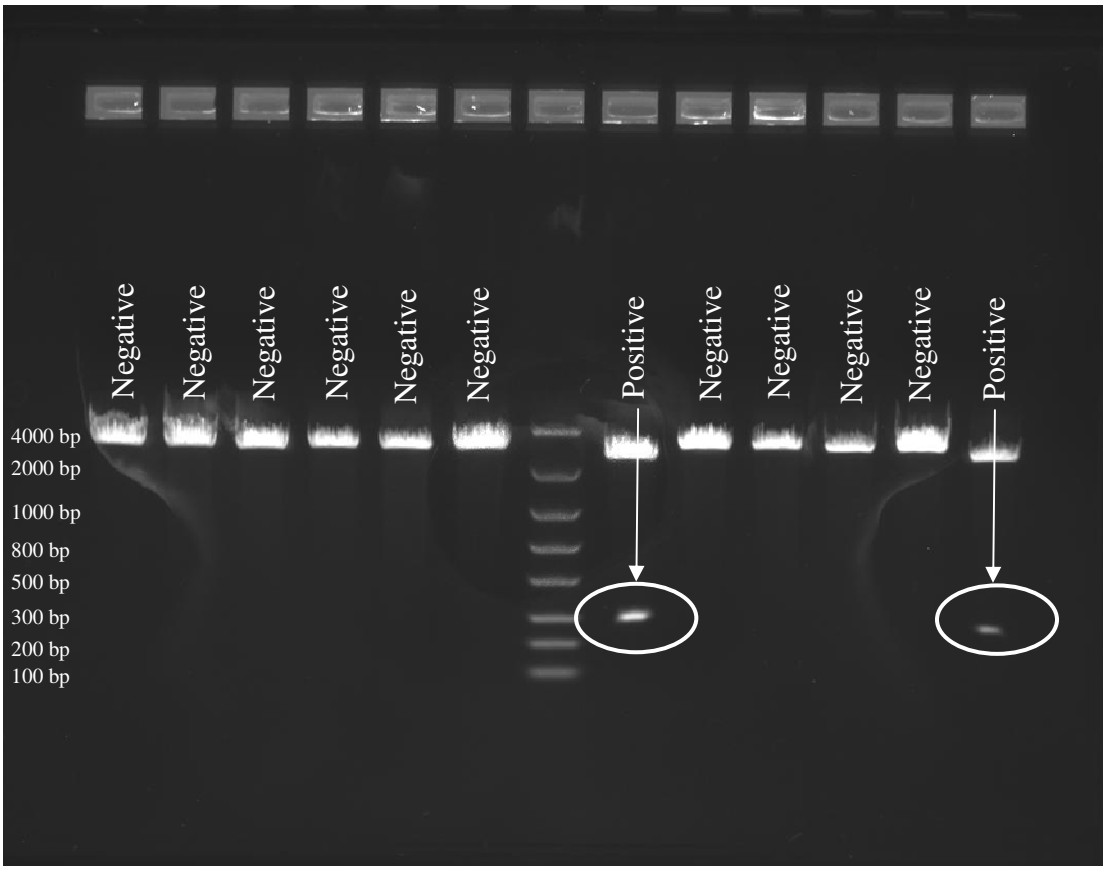


Figure 2S: Agarose gel showing SELP-815K-MMPRS colony screening for monomer gene segment. Colonies 7 and 12 are positive for insertion.

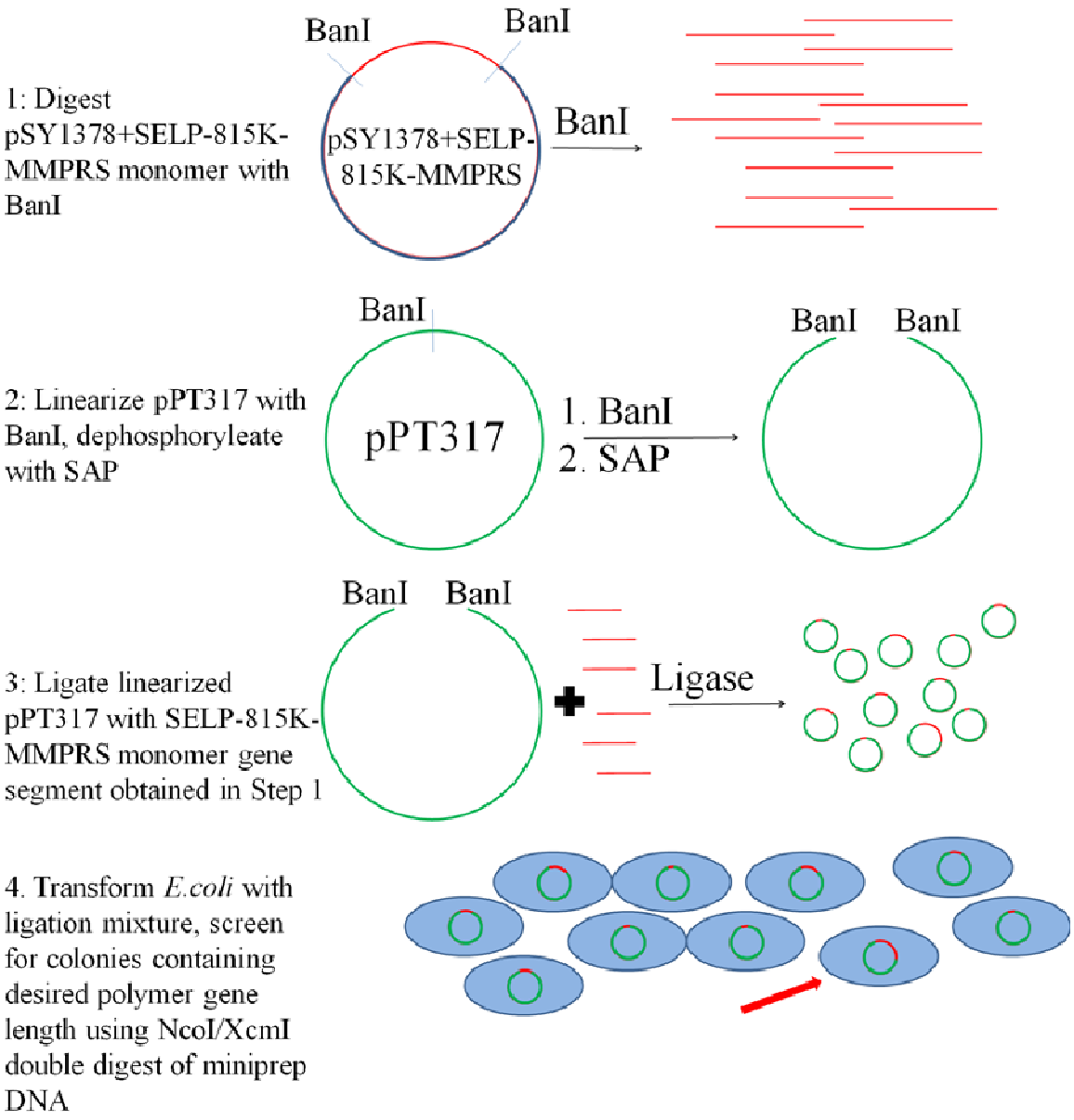


Figure 3S: Multimerization of SELP-815K-MMPRS gene segments

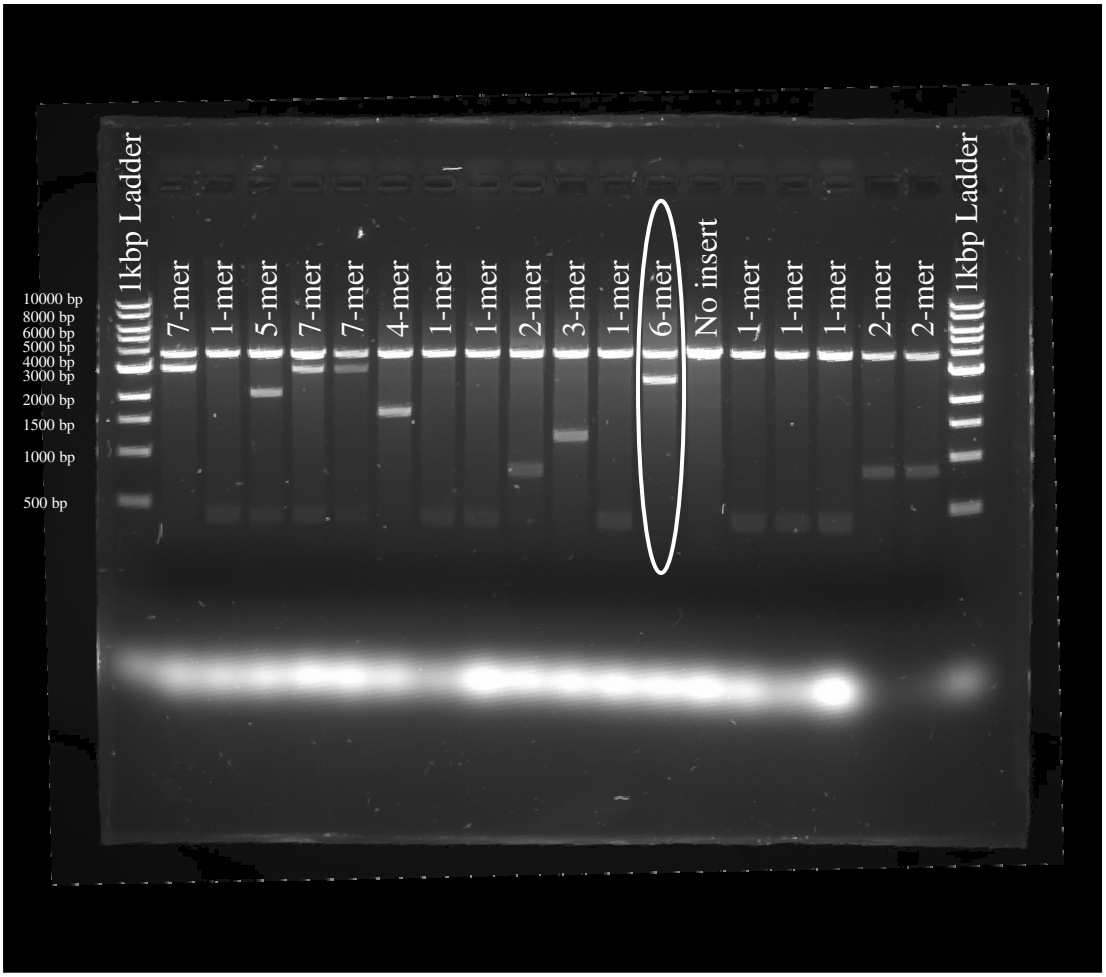


Figure 4S: Agarose gel showing SELP-815K-MMPRS polymer gene segments. Colony 12 contains a 6-mer polymer gene segment.

Table 1S

Oligonucleotide sequences for SELP-815K-MMPRS monomer gene synthesis

| | |
|---|---|
| Forward | 5'AGG ACC GCA AGG AAT TTT TGG ACA GCC TGG 3' (5' Phosphorylated) |
| Reverse | 5'TCC AGG CTG TCC AAA AAT TCC TTG CGG TCC 3' (5' Phosphorylated) |