***E. coli* expression vector**

*E. coli* is the widely used prokaryotic expression system. Different *E. coli* expression vectors contain different types of promoters for example lac, tac and T7 promoter-based vectors. Following are the examples of *E. coli* expression vectors based on various promoters.

* **The pGEX series of vectors**
* Although not naturally found in *E. coli* the synthetic tac promoter can be classified as *E. coli* promoter as it is created by fusing different elements of the lac and trp promoters making them more powerful than either of the parental promoters alone.The pGEX series of vectors have a tac promoter for chemically inducible, high-level expression.
* It is designed for prokaryotic expression of proteins as fusion products with Glutathion-S-transferase (GST) from *Schistosoma japonicum*. Since GST binds to reduced glutathione with high affinity, the recombinant protein can be easily purified by chromatography using glutathione-coupled sepharose beads.
* All pGEX vectors carry a lacIq gene coding for the lac repressor, which allows expression in all E. coli strains. The lac repressor ensures tight regulation of the introduced gene, preventing expression in uninduced cells. Induction of the tac promoter is achieved by IPTG, which, by binding to the repressor, relieves transcriptional repression.
* **The pET expression system**
* The pET expression system1 is one of the most widely used systems for the cloning and in vivo expression of recombinant proteins in E. coli. This is due to the high selectivity of the pET system’s bacteriophage T7 RNA polymerase for its cognate promoter sequences, the high level of activity of the polymerase and the high translation efficiency mediated by the T7 gene 10 translation initiation signals.
* In the pET system, the protein coding sequence of interest is cloned downstream of the T7 promoter and gene 10 leader sequences, and then transformed into E. coli strains. Protein expression is achieved either by IPTG induction of a chromosomally integrated cassette in which the T7 RNA polymerase is expressed from the lacUV5 promoter, or by infection with the polymerase-expressing bacteriophage lambda CE6.2 Due to the specificity of the T7 promoter, basal expression of cloned target genes is extremely low in strains lacking a source of T7 RNA polymerase.
* Upon induction the highly active polymerase essentially out-competes transcription by the host RNA polymerase. This phenomenon, together with high-efficiency translation, achieves expression levels in which the target protein may constitute the majority of the cellular protein—after only a few hours.
* **The pHSG396 and pHSG398 vectors.**
* The chloramphenicol resistant pUC vectors pHSG396 and pHSG398 contain the chloramphenicol resistance gene, the pMB1-derived origin of replication (ori), and the beta-galactosidase coding gene lacZ. These chloramphenicol resistant pUC vectors also contain a pUC18-derived multiple cloning site (MCS) within the lacZ gene, enabling recombinant clones to be verified through culture plates containing IPTG and X-Gal. High target gene expression is enabled by the presence of the lac promoter on both the pHSG396 and pHSG398 vectors.