

CASE STUDY

Don't Let DNA Synthesis Limit Your Best Antibody Candidates

Trust Ansa to Build the Best Sequence for Expression

Protein coding sequences have their own grammar — subtle patterns in codon choice, repeats, and GC content shape how efficiently a cell can read and produce them.

Codon optimization should serve the biology, but for most DNA synthesis providers, it quietly serves their own manufacturing constraints instead. For scientists, the goal is simple: keep the best antibody candidates in play and optimize them for expression. Traditional DNA synthesis providers bias their codon optimization algorithms away from features that would make a sequence “complex” in favor of sequences that are easier to synthesize (Figure 1). However, biology doesn't care about manufacturing constraints; sequences that express the best could be the most challenging for traditional providers to manufacture. As a result, using those codon optimization tools can result in scientists missing a promising antibody sequence simply because it was difficult for a vendor to synthesize.

HIGHLIGHTS

- **Synthesis to your exact design. No reworks, no tradeoffs.** Across 21 expression-optimized antibody sequences, Ansa classified all 21 as standard, while Vendor X required 11 to be re-optimized before accepting the order because they contained “complex features.”
- **Expression-first codon optimization increased antibody titers by an average of 1.9-fold.** In Axio BioPharma's standard CHO expression system, 19 of 21 Trias-optimized antibodies outperformed sequences optimized with Vendor X's tool.

Ansa unshackles researchers from that constraint: next-generation DNA synthesis designed to build complex sequences makes synthesis of the best candidates a reality, so you're no longer limited to the easiest ones to synthesize. Ansa manufactures many sequences that other vendors' guidelines exclude, including **high and low GC content, long or repeated elements, and predicted secondary structure**. Feasibility is returned per sequence in Ansa's ordering portal alongside a committed date, so customers can prioritize biology instead of redesigning around synthesis limitations.

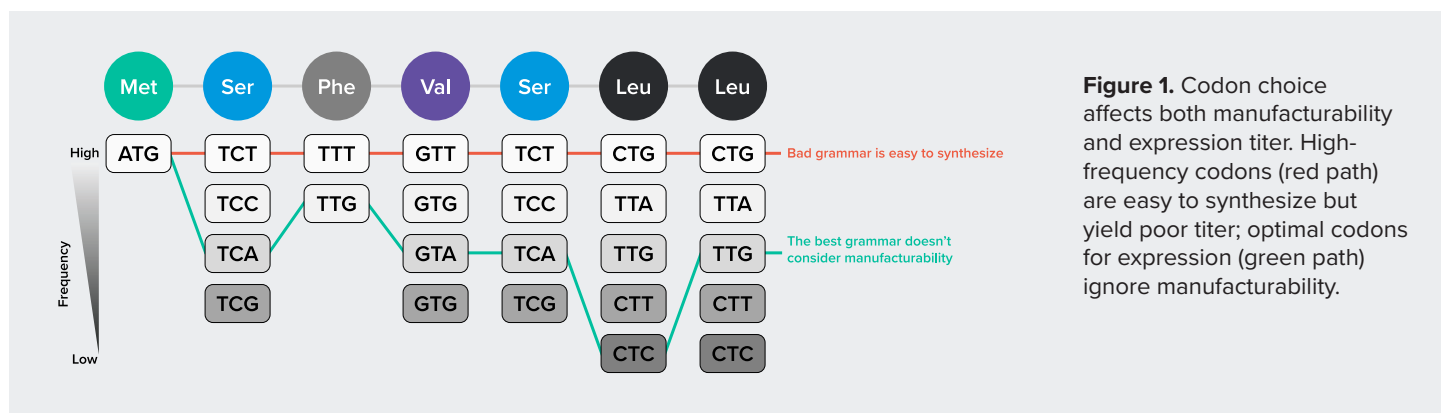


Figure 1. Codon choice affects both manufacturability and expression titer. High-frequency codons (red path) are easy to synthesize but yield poor titer; optimal codons for expression (green path) ignore manufacturability.

SEQUENCE MANUFACTURABILITY SCREENING:

All Trias codon optimizations scored as standard by Ansa, while Vendor X scored as either not manufacturable or complex.

To examine how codon optimization affects DNA synthesis feasibility, 21 monoclonal antibody sequences were codon optimized using Trias, an open-source large language model trained on the coding sequences of vertebrate genomes. Trias learns codon usage patterns from data, capturing long-range sequence dependencies to generate optimized, species-specific coding sequences designed to resemble natural ORFs.

The DNA sequences generated by Trias were screened for manufacturability by Ansa and Vendor X using each company’s standard ordering platform (Table 1). Ansa scored 100% as “standard” complexity, meaning customers could submit them directly for synthesis with high confidence in quality and on-time delivery. By contrast, Vendor X scored 11 sequences as “not manufacturable” because of sequence complexity and suggested that the user modify the sequences using its own codon optimization algorithm before an order could be placed. Vendor X scored the remaining 10 sequences as “complex,” a classification that can mean additional optimization, extra time, special handling, and higher pricing. For customers, the practical difference is clear: Ansa helps complex, expression-focused antibody designs move forward without forcing another redesign loop simply to address manufacturability.

Complexity Classification for Trias Codon Optimization		
Sequence Classification	Vendor X	Ansa
Not Manufacturable	11	0
Complex	10	0
Standard	0	21

Table 1. Manufacturability classification of 21 Trias-optimized sequences by Vendor X vs. Ansa.

ANTIBODY EXPRESSION TESTING IN CHO:

Using an expression-optimized design raised titers by 1.9-fold.

To compare expression outcomes from different codon optimization tools, Ansa worked with Axio BioPharma to benchmark the codon optimized antibody sequences using either the standard tool provided on Vendor X’s website or the sequences generated directly by Trias.

Mammalian expression vectors containing the Trias or Vendor X codon optimized ORFs were synthesized by Ansa and provided to Axio BioPharma for testing. Axio used its standard CHO cell expression system to test transient expression of the monoclonal antibodies and measured titers using protein A HPLC.

The results showed that the Trias-generated sequences produced higher antibody titers for 19 of the 21 sequences tested and improved expression by an average of 1.9-fold. Figure 2 shows a representative sample of six sequences that were either codon optimized by Trias (green) or by Vendor X’s tool (red). Ansa’s next-generation DNA synthesis can help customers preserve high-expression designs that might otherwise be constrained by a DNA manufacturability-first optimization.

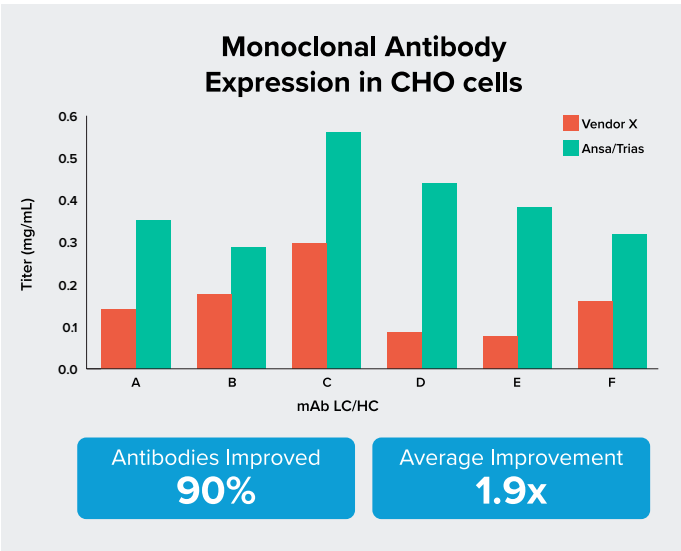


Figure 2. Monoclonal antibody expression titers in CHO cells, comparing Ansa/Trias (green) vs. Vendor X (red) codon optimization across six mAb light/heavy chain pairs (A–F).

Ansa helps antibody developers keep expression at the center of sequence design. By pairing advanced codon optimization with Ansa’s ability to synthesize complex DNA sequences that other vendors may reject, customers can pursue high-expression antibody candidates with greater confidence and fewer redesigns driven by manufacturing constraints.