

Amplification

Custom DNA oligos

Small- and large-scale custom solutions
and end-to-end services designed
with your unique application in mind

invitrogen

Experience you can count on

Since 1995, Invitrogen™ Custom DNA Oligos Synthesis Services have provided products for PCR, cloning, capillary electrophoresis (CE) sequencing, gene expression, microarray, next-generation sequencing (NGS), and other research-specific applications.

With a complete range of custom-synthesized oligonucleotide primers, probes, and genes—all built to your specifications and supported by a solid, worldwide infrastructure to help ensure on-time delivery, long-term sustainability, and exceptional service and support—you can expect quality, reliability, and convenience.

Whatever you encounter on your research journey, the Thermo Fisher Scientific team will partner with you every step of the way.

Manufacturing dedicated to your research

Our GMP oligos manufacturing site, located in Pleasanton, California, offers services from a team with a combined experience of more than 100 years. Your organization will receive dedicated ordering and fulfillment services that are integrated with your systems and processes. We can produce oligonucleotide components for further development of *in vitro* diagnostics (IVDs), analyte-specific reagents (ASRs), and laboratory-developed tests (LDTs).



Center for Oligo Excellence in Pleasanton, California

Oligos made to your specifications

Available in a range of synthesis scales, purification options, and modifications, our oligos are manufactured using state-of-the-art automated processes to increase performance, speed, and capacity. This means you will receive high-quality custom DNA oligos quickly and efficiently.

Cat. No. for	25 nmol	50 nmol	200 nmol	1 µmol	10 µmol
Tubes	10629186	10629012	10629020	10629053	10629087
Plates	10629152	10629160	10629178	10629053	10629087

Get the most out of your oligos

What is the difference between synthesis scale and delivered yield?

Synthesis scale refers to the amount of starting material, whereas delivered yield refers to the amount of actual material delivered. Because no reaction is ever at 100%, the delivered yield will always be less.

Explore our full suite of oligo calculators to help determine estimated yields based on the chosen scale, purification, and modifications at thermofisher.com/oligo-calculator.

What is coupling efficiency?

Coupling efficiency is a way of measuring how efficiently the DNA synthesizer is adding new bases to the growing DNA chain. If every available base on the DNA chain reacted successfully with the new base, the coupling efficiency would be 100%. Few chemical reactions are 100% efficient. During DNA synthesis, the maximum coupling efficiency obtainable is normally around 99%. This means that at every coupling step, approximately 1% of the available bases fail to react with the new base being added.

Learn more about how coupling efficiency affects the purity of your synthesized oligo at thermofisher.com/oligo-technical-resources.



Did you know we also offer specialized services for oligo synthesis?

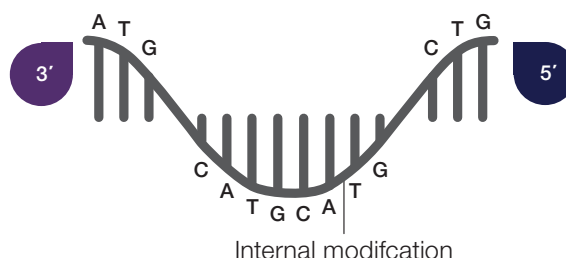
Let us help you customize your large-scale or complex oligos with the modifications, purification, and scales you need for your unique application.

Explore our capabilities at thermofisher.com/largescaleoligos

Modification options

We offer a wide variety of oligo modifications such as common and uncommon linkers, spacers, dyes, and modified bases, such as:

- Structural modifications, including LNA, L-DNA, and 2'-MOE
- Invitrogen™ Alexa Fluor™ dyes and other dyes
- Phosphorothioate bonds
- Degenerate bases



Modification type	Purpose in oligo design	Examples	Application(s)
Attachment chemistry or linkers	Linking oligos to another molecule or surface	Amino C6, C12 Biotin C6, TEG Thiol C3, C6	Affinity labels, fluorescent tags, etc.
Phosphorylation	For oligos being used as a substrate for DNA ligase	Phosphate 3' or 5'	DNA ligase; block DNA polymerase extension
Phosphorothioate bonds	Increase resistance to nuclease degradation	F, O, E, Z: IUPAC codes for phosphorothioated A, C, G, T	Therapeutic research; antisense research
Spacers	Physically create space between a moiety and hybridizing region of the oligo	C3 spacer, PC spacer	Attachment of fluorophores; block DNA polymerase extension
Modified bases	Aid in cross-linking and nuclease resistance	LNA, L-DNA	Therapeutic research
Fluorophores and quenchers	Re-emit/absorb light and emit heat	Alexa Fluor, Cy3, FAM, and Rhodamine Red dyes	Antisense research; qPCR and detection assays

Understanding the role of modifications in your oligo synthesis

How are modifications added?

Most modifications can be added to the oligo at any time during synthesis using reagents. There are some exceptions that require them to be added post-synthesis, and this is usually done by NHS ester chemistry protocols. 3' modifications can be added using the solid support.

How do modifications affect the final yield?

Some modifications need purification steps following the final synthesis step to remove impurities or failure sequences that can decrease the final yield of an oligo.

See a full list of available 5', 3', or internal modifications at thermofisher.com/oligo-configuration-options.



Did you know we specialize in complex modifications?

We are proud to offer an enhanced selection of custom oligonucleotide options that do not appear on our standard modification menus.

Contact our team for more information at thermofisher.com/custom-oligo-service-request

Purification benefits by application

With industry-leading purification platforms, we can deliver >90% purity designed to fit your needs.

Purification method	Description	Benefit	Application(s)	25 nmol	50 nmol	200 nmol	1 µmol	10 µmol
Desalt (25 nmol: 10–100 nt; 50 nmol: 5–100 nt)	Oligos are processed through normal-phase chromatography column, which removes salts but not failure sequences	A salt-free DNA solution, ready to use; suitable for many PCR and sequencing applications without further purification	<ul style="list-style-type: none"> • Endpoint PCR • Isothermal sequencing • Fluorescent sequencing • Microarrays • AFLP analysis 	•	•	•	•	•
Cartridge (50 nmol–1 µmol, 7–55 nt)	Based on reverse-phase chromatography; removes failure sequences from the completed synthesis	Provides full-length sequences needed in some applications	<ul style="list-style-type: none"> • Antisense • First-strand cDNA synthesis for generation of libraries 	N/A	•	•	•	N/A
HPLC (≥50 nmol, 10–55 nt; long oligo HPLC available)	Reverse-phase high-performance liquid chromatography (HPLC) removes failure sequences or unincorporated labels the same way as cartridge purification	Guarantees highly purified primer required in some applications (≥85% full length)	<ul style="list-style-type: none"> • Fluorescent sequencing • Gel shift assays • GeneTrapper screening • PCR using oligos with critical 5' sequences (e.g., restriction endonuclease sites, RNA polymerase promoters) 	N/A	•	•	•	•
PAGE (≥200 nmol, 7–100 nt)	Polyacrylamide gel electrophoresis (PAGE) is a method used to differentiate full-length product from failure sequences based on size and conformation	Provides the highest percentage of full-length oligos (≥85%) required for certain demanding applications such as mutagenesis or adapter production	<ul style="list-style-type: none"> • Production of cloning adapters • Site-directed mutagenesis 	N/A	N/A	•	•	•

Choosing the right purification method for your oligo

Why purify an oligo?

Following DNA synthesis, the completed DNA chain is released from the solid support using basic solutions such as ammonium hydroxide. This solution contains the required full-length oligo but also contains all the DNA chains that failed to couple during synthesis. These failure sequences can compete with the full-length product in some applications, such as site-directed mutagenesis, production of cloning adapters, and antisense, to name a few. These failure sequences need to be removed before the oligo can be used successfully.

Which purification option should I choose for my application?

Generally, desalted oligos can be used for PCR, whereas for an application like site-directed mutagenesis, full-length oligos tend to give the highest percentage of mutagenized clones (especially if the intended mutation is close to the 5' end of the oligo).

Get additional guidance on purification options at thermofisher.com/oligo-purification-options.



Did you know that the oligonucleotide purification technique you choose depends on a variety of factors?

Some considerations include:

- Downstream application
- Presence of specific modifications
- Desired length
- Required yield

Read this oligo spotlight article to learn more about the advantages and drawbacks of each method at thermofisher.com/oligopurificationspotlight



Quality control

All our oligo laboratories operate under ISO 9001 and ISO 13485 certifications and are maintained under our quality management systems. We use a scalable quality approach that is customized to your needs and requirements and provides traceability and good documentation practices, including certificates of analysis, to help ensure consistent quality and safety downstream. Our process includes 100% in-process trityl monitoring with up to 12 measurements taken for every base addition and analysis by capillary electrophoresis, mass spectrometry (MS), optical density, and liquid chromatography–mass spectrometry (LC-MS) to verify the yield and purity of the product.

Quality

Why is LC-MS a good MS option for your oligo?

LC-MS is a combination of physical separation by liquid chromatography with mass analysis from mass spectrometry. This provides both mass confirmation as well as impurity identity information.

What are trityl readings in the QC process?

The trityl group is colorless when attached to a DNA base but gives a characteristic orange color once removed. The intensity of this color can be measured by UV spectrophotometry and is directly related to the number of trityl molecules present. By comparing the absorbance of trityl releases throughout synthesis, it is possible to calculate the percentage of bases coupling successfully and, hence, the coupling efficiency.



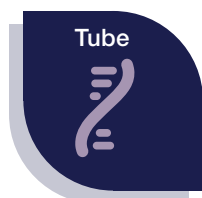
Did you know ISO and FDA certifications address different aspects of manufacturing processes and systems?

- ISO 13485:2016: “Requirements for a quality management system where an organization needs to demonstrate its ability to provide medical devices and related services that consistently meet customer and applicable regulatory requirements [1].”
- “CGMP refers to the Current Good Manufacturing Practice regulations enforced by the FDA. CGMPs provide for systems that assure proper design, monitoring, and control of manufacturing processes and facilities [2].”

Ordering options

Online ordering for small-scale oligos

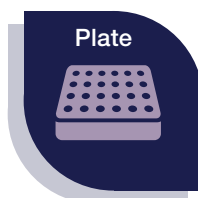
Fast and easy ordering of small-scale oligos is straightforward using our enhanced ordering portals online. Upload or input sequences with the custom modifications and purifications you need using our standard or plate ordering tools. Share your cart, save for future reorders, and keep track of all purchases.



Tube

- Pay per base with 5', 3', or internal modifications
- 25, 50, and 200 nmol; 1 and 10 µmol
- Standard or next-day delivery
- Enhanced bulk ordering portal: easy and fast

Order standard oligos now at thermofisher.com/custom-dna-oligos



Plate

- One complete order with the same purification, synthesis scale, ship medium, and buffer
- 96- or 384-well plate format
- Easy, templated upload of Microsoft™ Excel™ files

Order plate oligos now at thermofisher.com/plateoligos

Online requests for large-scale and complex oligos

If you're looking for a certain purity percentage target or a modification that isn't available on our website, or if you want to order in large-scale formats from milligrams to multigrams, Oligo Large Scale and Manufacturing Services can help you customize your project.



Complex

- Milligram to >15 gram delivered yields
- Unmodified and modified DNA or RNA up to 100 bases
- ISO 9001 and ISO 13485 controlled process
- Custom formulations and packaging solutions

Explore complex oligo services and support at thermofisher.com/largescaleoligos



Did you know we offer a free Primer3-based, online primer designer for your PCR, CE sequencing, and cloning success?

- **Save time when designing your primers**—design up to 50 genes at the same time for PCR or CE design
- **Order with ease**—select and add primers directly to your online cart from the design tool*
- **Store your data**—save your projects
- **Work smarter**—use .txt and .fasta file types

* Pricing and "add to cart" feature may vary by geographic region. For questions, please contact your local office or distributor at thermofisher.com/contactus.

Try the upgraded Invitrogen™ OligoPerfect™ Primer Designer at thermofisher.com/oligoperfect-designer, or visit the oligos utility hub for our full suite of tools at thermofisher.com/oligotools

Complex oligo technical design support

Our oligo synthesis technical project managers will work with manufacturing sciences, product management, and your internal teams to deliver your oligo design within your specifications. Let us handle the technical development so you can get back to discovering what's next.

Are you interested in having a conversation with our technical teams?

Below are three easy steps to start our technical evaluation of your project today:



Gather all technical requirements such as delivered yield, purity targets, modifications, and delivery formats (tubes, plates, and aliquots). Having a budget and timeline is also helpful.

Tip: if you have your final sequences ready to go, request a Technical Sales Specialist to start the NDA process. Sequence evaluation is often an important step for us to give you an accurate quote.



Send technical requirements to our Oligo Inquiries team at oligoinquiries@thermofisher.com. One of our technical project managers will reach out to you within 24 hours to start your project kickoff and answer any technical questions.

Tip: if you would like to discuss your technical requirements, you can request a technical call with our teams.



Your technical project manager will work with our internal manufacturing science teams to determine feasibility, timeline, and price. They will send you a comprehensive quote and work within your budget and timeline. Additional technical discussions can also be requested.

Once connected with our team, here's the process to expect:



Did you know we offer additional manufacturing services, including OEM scale-up and support?

Leverage our expertise and infrastructure. We can manufacture products with your labels and packaging.

Explore OEM and commercialization options at thermofisher.com/oem

Shipping

Different modifications, scales, order sizes, oligo lengths, and purification choices will demand different lengths of synthesis time. When designing your oligos on our Standard Design Tool, we provide estimated ship dates, depending on the design selections you choose.

Check your local delivery schedules for more information at

thermofisher.com/oligo-ordering-delivery

Troubleshooting support

Our technical support team offers troubleshooting to our customers for a variety of applications such as mutagenesis, sequencing, PCR, cloning, and gene construction.

Oligo inquiries: oligoinquiries@thermofisher.com

Global technical support: techservices@thermofisher.com



Did you know we offer a full suite of products and services for your research needs?



Learn more about PCR and cloning solutions at thermofisher.com/pcrandcloning

References

1. ISO 13485:2016. Medical Devices—Quality Management Systems—Requirements for Regulatory Purposes. International Organization for Standardization (ISO), last modified March 2016. [iso.org/standard/59752.html](https://www.iso.org/standard/59752.html)
2. Facts About the Current Good Manufacturing Practices (CGMPs). US Food & Drug Administration, last modified June 1, 2021. [fda.gov/drugs/pharmaceutical-quality-resources/facts-about-current-good-manufacturing-practices-cgmps](https://www.fda.gov/drugs/pharmaceutical-quality-resources/facts-about-current-good-manufacturing-practices-cgmps)

Explore our full suite of oligo solutions, services, and support at thermofisher.com/oligos

invitrogen