
life
we believe the
answers are growing
Products to empower your plant science research
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invitrogen
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TaqMan
novex
molecular probes
ambion
ion torrent
life technologies™

Plant research tools from Life Technologies

Life Technologies has innovative technology platforms optimized for each step of different plant biotechnology workflows: from genomic tools enabling the understanding of plant genetic makeup, to DNA manipulation, gene and protein expression, cell imaging, and copy-number analysis.

From Ion Torrent™ semiconductor sequencing, to GeneArt® algae engineering and DNA assembly tools, to TaqMan® assays for genotyping and copy number analysis, we have the widest selection of products and technologies to help address challenges like food production, land conservation, and protecting plant biodiversity and natural habitats.

Visit **www.lifetechnologies.com/agbio** to learn more and purchase our products and solutions.

Understanding the challenges in plant science research

While the genomics revolution has expanded our understanding of plant biology considerably, the pace of discovery will continue to increase. Only now are we starting to fully appreciate the complexity of the challenges ahead, namely, translating this knowledge into added value in agricultural biotechnology and other plant biotechnology applications such as biofuels and crop optimization.

Plant science researchers are working to answer critical questions, including how to create crops that increase yields, grow in unfavorable conditions, and produce compounds of interest. However, the majority of commercially available molecular biology kits and reagents are not validated for specialized plant and agricultural biotechnology workflow challenges. Some of these are higher ploidy levels, cell structures that are difficult to manipulate, and organisms that can overcome scientists' attempts to modify genetic material. Life Technologies has research products and platforms that overcome these unique challenges.

Brassica sp. (canola) seeds

Providing integrated tools

Our vision for plant and agricultural biotechnology is to provide integrated platforms and tools to enable sequence-to-function plant analysis, and software solutions that allow scientists to design genetic tools to produce particular phenotypes *in silico*. We envision a world where plants are sources for energy, plastics, biomaterials, drugs, therapeutic applications, and valuable chemicals—all produced in ways that sustain and responsibly use our planet's natural resources.

Access powerful technologies for whole genome sequencing, targeted resequencing, and more

Uncovering the genetic makeup of plants and how altered expression of genetic variants contributes to complex plant phenotypes in different environmental conditions is fundamental not only to answering basic research questions in plant biotechnology but also to designing next-generation crop plants. Life Technologies instructments, reagents, and analysis software will get you there faster and more reliably and accurately.

- **Ion Torrent™ semiconductor sequencing:** scalability, simplicity, and speed for every benchtop
- **Applied Biosystems® Genetic Analysis Systems:** gold-standard technology—the ultimate sequencing verification tool
- **5500 Series Genetic Analyzer Systems:** highest accuracy for discovery of novel causative variation and a multitude of fragment analysis–based applications like AFLP, SSCP, and more

PGM™ System

Featured product: Personal Genome Machine (PGM™) System

The Ion PGM™ sequencer is an affordable next-generation sequencer that uses semiconductor technology to provide fast, simple, and affordable sequencing. The system leverages the exponential improvements in the semiconductor industry (known as Moore's Law) to provide scalability and flexibility for various applications like targeted resequencing of gene panels, genotyping, and RNA sequencing. Direct real-time sequencing detection enables a single-day workflow, 2-hour run times, and accessibility to any lab.

Learn more at **www.lifetechnologies.com/iontorrent**

Isolate and purify high-quality nucleic acids from plant samples

Working with plant DNA and RNA has unique challenges that require kits specifically designed to deal with carbohydrates, phenolics, and other compounds abundant in plant tissues.

- **Invitrogen™ DNA purification systems:** unique and cutting-edge purification methods that facilitate everything from isolation to amplification in the same tube
- **Ambion® RNA purification:** collection, stabilization, and purification of total RNA, mRNA, microRNA, or transcriptome RNA from plants
- **Nucleic acid gel electrophoresis and blotting:** high-quality tools for agarose and acrylamide gel electrophoresis experiments
- **Nucleic acid quantitation:** accurate quantitation using the Qubit® 2.0 Fluorometer

Learn more at **www.lifetechnologies.com/naprep**

***Helianthus annuus* flower**

Featured product: PureLink® Genomic Plant DNA Purification Kit

The PureLink® Genomic Plant DNA Purification Kit allows rapid and efficient isolation of total DNA from a wide range of plant tissues, including alfalfa sprouts, sunflower sprouts, soybeans, tomato leaves, wheatgrass, and *Arabidopsis thaliana* leaves. Even with difficult samples such as chloroplast DNA, the higher yields obtained are enough to perform PCR successfully. Once isolated, DNA is ready to use for amplification, restriction digests, and other routine applications. Typical yields obtained with this kit are shown in the table.

Typical yields of genomic DNA obtained from various plant samples.

Sample	Yield*
Spinach	2.0–2.5 µg
Arabidopsis thaliana	1.8–3.1 µg
Alfalfa	2.1–3.0 µg
Sunflower	1.6–4.0 µg
Soy	0.3–2.0 µg
Wheat	9.2–14.6 µg
Corn	4.4–6.6 µg
Tomato	1.0–2.3 µg

* DNA yield depends on the type and amount of starting material used.

Manipulate and clone plant DNA easily

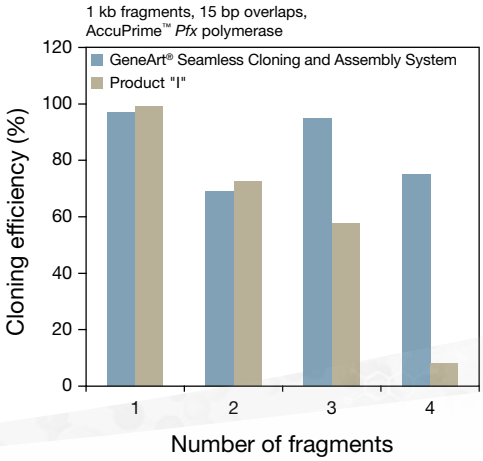
Arabidopsis thaliana plants

Cloning plant DNA is a key step for genetic engineering, gene studies, and other aspects of plant biotechnology research, both in discovery and applied settings. The development of genetically modified plants often requires complex design and assembly of DNA elements to achieve optimal effects. Life Technologies offers solutions for all steps of workflows, such as cloning reagents and kits, and products for DNA amplification and sequence analysis.

- **GeneArt® DNA assembly kits and gene synthesis service:** Our latest technology for simultaneous cloning of complex DNA elements can be combined with GeneArt® gene synthesis services for the design of synthetic genes with enhanced heterologous gene expression in transgenic plants.

- **Gateway® cloning:** The expression platform of choice for plant systems, with a wide range of vectors for different plant species and purposes. Adapted Gateway® vectors for *Agrobacterium*-mediated transformation, silencing studies, and many other applications have been cited in over 150 peer-reviewed articles.

- **Basic cloning reagents:** From competent cells to DNA oligos to TOPO® cloning kits, everything you need for your everyday cloning needs. Browse our entire offering at **www.lifetechnologies.com/cloning**.



Featured product: GeneArt® Seamless Cloning and Assembly Kit

The GeneArt® Seamless Cloning and Assembly Kit enables the simultaneous and directional cloning of 1 to 4 PCR fragments (any sequence) into any linearized vector, without extra sequences or restriction endonuclease digestion or ligation, in a single 30-minute room temperature reaction. The free online DNA oligo designer guides users through experimental design. The kit delivers high cloning efficiencies across a wide range of fragment sizes and numbers, as depicted in the graph.

Learn more at **www.lifetechnologies.com/dnaassembly**

Analyze SNP variation and gene expression to understand plant phenotypes

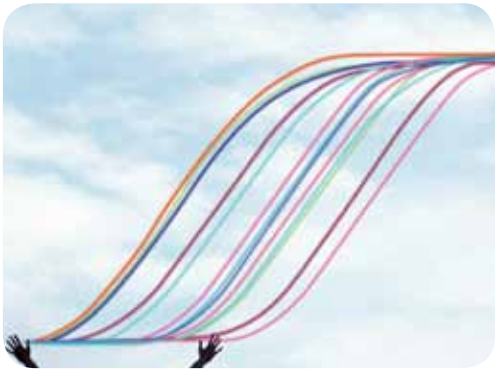
Screening genetic markers that correlate with selectable phenotypes requires the right tools. Single nucleotide polymorphism (SNP), genotyping, gene expression profiling, and other genetic variation studies help associate those differences so that you can select the right plant seed line, move a transgenic plant to the greenhouse, or collect critical data for your publication. Life Technologies is a leader in providing reagents and tools for sequencing, real-time PCR, informatics, array labeling, and gene mapping, for targeted and genome-wide discovery of SNPs, copy number variants, and other genetic variations.

Learn more at **www.lifetechnologies.com/agbioqpcr**

From few samples and targets to high-throughput applications, there are TaqMan® Assay formats to fit your needs.

Featured product: TaqMan® Assays

- **TaqMan® Assays, custom probes, and reagents:** The industry benchmark for real-time quantitative PCR (qPCR), TaqMan® solutions have been developed and optimized for a multitude of genomic applications for plant researchers: gene expression, SNP genotyping, copy number variation, and microRNA profiling.
- **TaqMan® SNP genotyping assays:** TaqMan® 5´-nuclease assay chemistry provides a fast and simple way to get single nucleotide polymorphism (SNP) genotyping results. With 4.5 million predesigned TaqMan® SNP assays available and a robust custom design pipeline, genotyping with TaqMan® Assays is an ideal method for validating and screening SNP markers and plant species. With a choice of Applied Biosystems® real-time PCR instrumentation or the OpenArray® real-time PCR platform, you can select the workflow that best fits your genotyping project needs.



Learn more at **www.lifetechnologies.com/taqman**

Explore plant protein expression

Plants are increasingly being examined as alternative recombinant protein expression systems and hosts for bioproduction. Advance your engineering and proteomic workflows using the comprehensive portfolio of products from Life Technologies. You can isolate peptides, proteins, and protein complexes directly from your crude sample for further analysis. We offer innovative solutions for studying posttranslational modifications and for correlating RNA and protein expression levels in the same sample.

- **Protein sample preparation and purification:** Perform immunoprecipitation, protein complex pull-downs, organelle isolation, and many other techniques with a wide range of magnetic Dynabeads® products and reagents.

- **Electrophoresis instruments, precast protein gels, power supplies, and accessories:** We offer a variety of Invitrogen™ gel electrophoresis chamber systems and power supplies compatible with protein gels available in several different chemistries, well formats, and gel sizes. Now you can get the separation you need for accurate downstream results through leading brands like NuPAGE® and Novex®.

- **Western blot analysis:** The most comprehensive portfolio of products for western blot analysis. From the innovative iBlot® Dry Blotting System that enables 7-minute protein transfers, to quality precut transfer membranes and convenient western detection kits, this array of products meets all your western blotting and analysis needs while speeding up the whole process.

GeneArt® Algae Engineering Kits

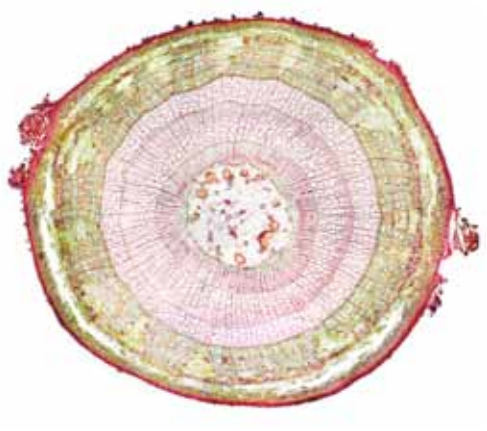
Featured product: GeneArt® Algae Engineering Kits

GeneArt® Algae Engineering Kits for *Chlamydomonas reinhardtii* and *Synechococcus elongatus* are the first commercially available genetic modification and expression systems for photosynthetic microalgae. Previously, algae research and production labs relied on poorly characterized, non-optimized cell stocks and cloning tools for their work. Preparing growth media was convoluted and time-consuming, and growth rates and yields from the transformed cells were disappointing. These kits are designed for rapid scale-up and production and consistent, defined quality. Our GeneArt® products and solutions are at the forefront of research, bringing you the predictability, adaptability, scalability, and confidence required to unleash the full potential of this promising field.

Learn more at **www.lifetechnologies.com/algaekit**

Visualize and study plant cells and tissues

Understanding the structural and functional relationships of plant cells and tissues is critical to plant research and to demonstrating the mechanism of action of a new trait. They are also important in the process of deregulating new plant varieties. Life Technologies has a broad portfolio of reagents, kits, and instruments for cell and tissue analysis—from antibodies to flow cytometry instruments to Molecular Probes® fluorescence imaging tools—all designed for the unique challenges presented by plant tissues.



Tilia stem at 430x

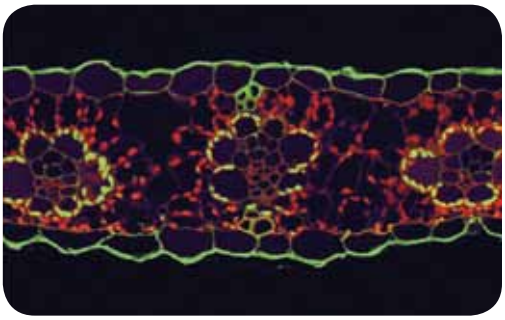
- **Molecular Probes® fluorescent dyes and probes:** Broad array of products for many applications and platforms, including Alexa Fluor® dyes, Qdot® nanocrystals, Click-iT® detection assays, ProLong® Gold antifade reagent, and more.
- **Flow cytometry:** Higher-plexed multicolor flow cytometry reveals more information about each individual cell—in less time, with less sample. From the Attune® Acoustic Focusing Flow Cytometer to the broadest range of fluorescent antibodies for flow cytometry and reagents to maximize the use of your instrument.

Learn more and see all of our products at **www.lifetechnologies.com/probes**

Alexa Fluor® dyes

The leading and most trusted fluorescent dyes available today have been used extensively in plant sciences. In addition to superior performance you'll get an experienced, problem-solving technical support team, over 30,000 published references, application and experimental tips, and protocols to help with experimental planning. Our range of labeling kits, molecules for tracing cell structures, and secondary detection reagents within the Alexa Fluor® product line provide superior brightness and photostability, outperforming conventional fluorescent reagents across the spectrum.

Learn more at **www.lifetechnologies.com/alexa**



Corn leaf section with fluorescent staining.
Image contributed by Todd Jones, DuPont.

Detect gene copy number and uncover the genotypes of plant populations

Corn field

Effective, high-throughput methods for genotyping and copy number analysis are enhancing our understanding of how to breed food crops for higher yields and better disease resistance. Rapid genotyping of plant species all over the world will allow researchers to determine which species have direct benefits for human health. Life Technologies has a leading portfolio of instruments, reagents, and solutions for this purpose.

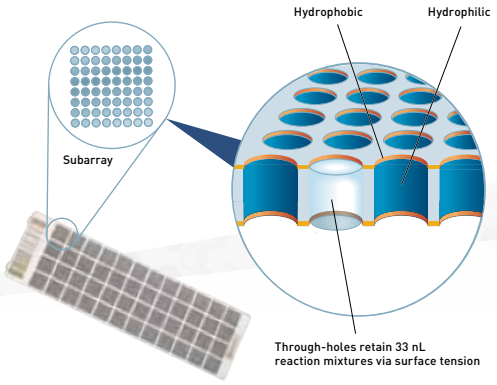
Learn more at **www.lifetechnologies.com/agbio**

QuantStudio™ 12K Flex Real-Time PCR Instrument with AccuFill™ System

Featured product: QuantStudio™ 12K Flex Real-Time PCR System

The QuantStudio™ 12K Flex Real-Time PCR System sets a new standard for automated analysis for researchers conducting large-scale studies. The streamlined OpenArray® workflow helps save time and resources compared to running experiments in multiple 384-well plates. When equipped with the OpenArray® block and the AccuFill™ System, the QuantStudio™ 12K Flex System can produce up to 110,000 data points or more in an 8-hour day with minimal training, with as little as 20 minutes of hands-on time per run, and no third-party robotics.

Learn more about this and other applications at **www.lifetechnologies.com/quantstudio**



OpenArray® plate technology

OpenArray® technology

OpenArray® technology is a broadly applicable nanoliter fluidics platform for low-volume, solution-phase reactions. Benefit from the parallelism of microarrays and the data quality of solution-phase reactions such as PCR, with the QuantStudio™ 12K Flex System.

QuantStudio™ 12K Flex OpenArray® plates are microscope slide–sized and are arranged in 48 subarrays of 64 through-holes, with a total of 3,072 through-holes for individual 33 nL reactions. Plates are coated with hydrophilic and hydrophobic compounds to retain reagents in through-holes via surface tension.

Diagnose the presence of GMOs in a variety of samples

Testing for bioengineered genetically modified organisms (GMOs) is now required following legislative action in an increasing number of countries. We offer kits to detect GMO-specific DNA sequences in seed, grain, and processed foods and their ingredients, with high confidence.

Corn field

Featured product: TaqMan® GMO Detection and Quantitation System

The TaqMan® GMO Detection and Quantitation System is a full product line of GMO assays that can detect the presence of GMO-specific DNA sequences in seed, grain, and processed foods and their ingredients. TaqMan® GMO kits are part of a highly sophisticated, user-friendly system that includes DNA sample preparation, automated PCR amplification and signal detection, data analysis, and quantitation software, thus eliminating the need for personnel trained in molecular techniques.

Learn more at **www.lifetechnologies.com/foodtesting**

Corn kernels

Contact Life Technologies to help you achieve the next wave of remarkable plant science discoveries.

For a full selection of our products for plant research, visit **www.lifetechnologies.com/agbio**

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