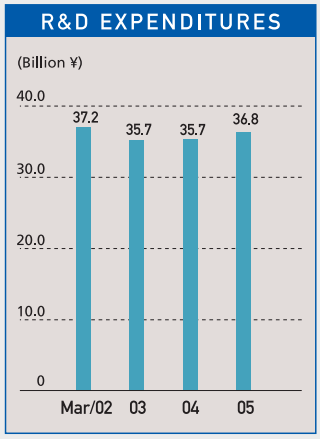
Research & Development

Consolidated R&D expenditures totaled ¥36.8 billion and represented 2.8% of sales in FY Mar/05. R&D expenditures at Toray Industries totaled ¥30.1 billion, 6.3% of its sales.

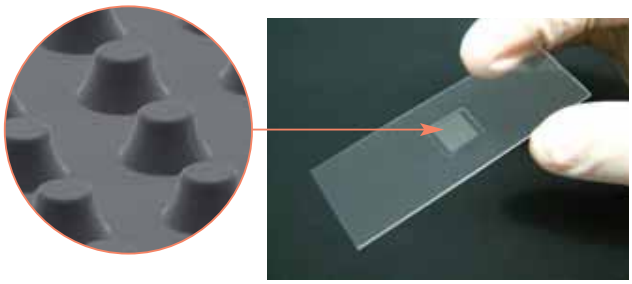
Toray has to date supplied a number of advanced materials to the world, and we are committed to continuing to develop and supply advanced materials in IT-related products, life sciences, and environment, safety and amenity—all three growth areas. We believe these efforts are central to the identity of the Toray Group.

During FY Mar/05, we launched our new Project NT-II management reform program and adopted an "offensive" management approach based on business-structure reform. Over the past year in R&D, we have focused on three elements in working to expand our range of offerings in advanced materials (the "SZ Project"-from *sentan zairyo,* the Japanese word for advanced materials): First, we sought to shorten time to market for new products resulting from our R&D efforts through commercialization projects entailing the emplacement of the requisite organizational, human, and manufacturing infrastructure and partnerships with other leading companies. Second, we sought to enhance our R&D project development capabilities (ability to come up with new ideas for large-scale R&D programs) by drawing on our ability to keep our ears to the ground (at our overseas operational bases as well), combine people and technologies from different fields, and undertake quality planning. And third, we sought to generate unique technologies, for example by working more closely with venture companies and innovatively combining elemental technologies. These efforts laid the groundwork for our "offensive" management approach based on the creation of new advanced materials.



Next-generation DNA chip substrate with high sensitivity and fast detection

Toray has successfully developed the world's first high-performance DNA chip substrate with a detection sensitivity up to 100 times greater and a detection speed shortened to one-tenth those of conventional DNA chip substrates. This DNA chip substrate holds promise for use in next-generation DNA chips for a wide range of applications, including genome drug discovery, in addition to DNA chips used in testing and diagnostic applications. It represents part of the research results at the New Frontiers Research Laboratories established in 2004, and we are now in the



Highly sensitive, high-speed detection DNA chip

process of exploring the conditions and equipment that will be necessary for its manufacture. We are working to develop a business model that includes alliances with research organizations that will bring this DNA chip substrate to de-facto global-standard status and, at the same time, we aim to market DNA chips loaded with Toray-developed content within two years.

World's first cellulose fiber using environmentally-friendly manufacturing process

Toray is the first in the world to successfully manufacture cellulose fiber using low environmental-impact manufacturing processes. Cellulose fiber derived from natural materials has superior moisture-absorption properties, texture, and dyeability, but until now could only be manufactured through a solution spinning process using an environmentally detrimental organic solvent. Based on research done in cooperation with the New Energy and Industrial Technology Development Organization (NEDO) and the Nishio Laboratory at Kyoto University, Toray was able to manufacture cellulose fiber using a melt spinning method without organic solvents, which is the manufacturing method usually used for polyester, nylon, and other fibers. Toray has been developing this melt spinning technology for many years, and its application makes it easy to manufacture composite fibers combining modified cross-section fibers and different polymers. We position cellulose fiber manufactured with the melt spinning method as a next-generation, environmentally-friendly material, and we hope to extend its use to a wide range of products.

Accelerated development of practical carbon fiber applications in car bodies

Toray is a leading global supplier of carbon fiber reinforced plastics (CFRP), and we were the first in the world to develop a high-speed molding technology that enables their use in the mass production of car bodies and other products. We significantly advanced the mass production of cars that use CFRP by shortening molding times to less than ten minutes, or roughly one-fifteenth the time previously required, by dramatically improving the processing attributes of resin combined with carbon fiber. CFRP is attracting interest as a leading candidate for a next-generation car material satisfying both safety and lightweight requirements thanks to its excellent weight and strength characteristics compared to high-tensile steel, which has an inherent maximum strength as a metal. A lack of mass-production technology and high costs, however, were a major hindrance to commercialization CFPR products. Our shortening of CFRP molding times provides an extremely effective solution to both problems, and, as a result, we expect the practical use of CFRP in car bodies to accelerate. This technology was developed as part of a national project—called the R&D of Carbon Fiber-Reinforced Composite Materials to Reduce Automobile Weight—commissioned by NEDO and undertaken jointly with Nissan Motor Co., Ltd. beginning in FY Mar/04.

New cellulose fiber enables a variety of cross section shapes that were previously impossible

Prototype of car body material using new molding method

Main Press Releases from April 2004 to March 2005

2004	April	Augmenting carbon fiber composite material production capacity in the US to meet growing mid- to long-term demand
	May	Reorganizing film business in Japan to enhance the overall capabilities of the film processing business (establishment of Toray Advanced Film Co., Ltd.) Building third plant at Matsushita Plasma Display Panel Co., Ltd. in Amagasaki, Hyogo Prefecture (joint announcement with Matsushita Electric Industrial Co., Ltd.) Concluded a basic agreement with Boeing Company of the US to supply carbon fiber composite materials on a long-term basis Consolidating production of caprolactam, a raw material in nylon, and strengthening the structure of this business
	June	Augmenting production capacity for *Metaloyal**, a two-layer substrate film for use in high-density FPC boards, in response to growing demand for flat-panel displays (Toray Advanced Film Co., Ltd.) Launched Toray Synthetic Textile Cluster to reinforce the world's strongest synthetic textile business Commercializing environmentally friendly carpet that uses *Ecodear** polylactic acid fiber
	July	Started releasing new *TOREX** commercials Developed world's first flexible polylactic acid film Augmenting production capacity for 3GT (polytrimethylene terephthalate) fiber (composite thread), which has superior softness, stretchability, and durability Augmenting polypropylene film (OPP film) production capacity in response to growing demand for film capacitors Started purchase of common stock in Chori Co., Ltd. through tender offer Reorganizing and expanding polyester film production in Asia in response to the growing market for digital consumer electronics and other products Made Suido Kiko Kaisha, Ltd. a consolidated subsidiary through the acquisition of additional stock
	August	Completed purchase of common stock in Chori Co., Ltd. through tender offer
	September	Developed next-generation DNA chip substrate Opened antenna shop in Mitsukoshi, Ltd.'s main store for Toray's *TOREX** brand of fiber and textile products
	October	Strengthening research and development in China Published CSR Annual Report 2004 Developed new nanotechnology-based textile processing technology Established Plastics Ecology & Recycling Department Releasing futon mattress that uses *Ecodear** polylactic acid fiber (joint announcement with Nishikawa Living Inc.)
	November	Launching new polysulfone membrane artificial kidney business
	December	Releasing *Sotake Filluna** an ecological material that uses bamboo as a raw material Licensed manufacturing technology for white polyester film used in liquid crystal reflectors to DuPont Teijin Films Developed thermoplastic with world's highest thermal conductivity
2005	January	Launching water treatment engineering business in China (capital participation in Wuzhou Fujikasui Engineering Co. Ltd. through Suido Kiko Kaisha, Ltd.) Applying plant-derived material in large-size laptop plastic chassis (joint announcement with Fujitsu Ltd. and Fujitsu Laboratories Ltd.) Augmenting production capacity for polyester film used in capacitors at Yihua Toray Polyester Film Co., Ltd. Took measures to deal with dioxin emissions in excess of standards for the wastewater at the Tokai Plant
	February	Augmenting airbag nylon production capacity in Thailand Augmenting production capacity for *Metaloyal**, a two-layer substrate film for use in high-density FPC boards (Toray Advanced Film Co., Ltd.) Established basic technology for zero-emission membrane bioreactor, the ultimate membrane-based wastewater treatment method Launched recycling of used household air-conditioner fans (joint announcement with Mitsubishi Electric Corp.) Developed world's first cellulose fiber using melt-spinning method Developed world's first ultrasensitive polymer protein-analysis chip Adopting Toray Nanotechnology Symbol Mark to certify high-performance, high-quality nanotechnology materials
	March	Agreed to jointly develop and market new antipruritus drug to hemodialysis patients in Japan (joint announcement with Japan Tobacco Inc. and Torii Pharmaceutical Co., Ltd.) Enhancing resin technology development in the ASEAN region Augmenting LCD color filter production capacity Discovered soil pollution through survey at Nagoya Plant and established action program Agreed to jointly develop and market new antipruritus drug to atopic dermatitis patients in Japan (joint announcement with Maruho Co., Ltd.)