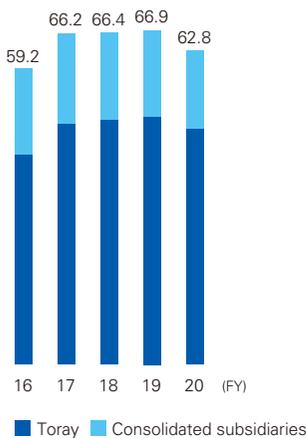


R&D

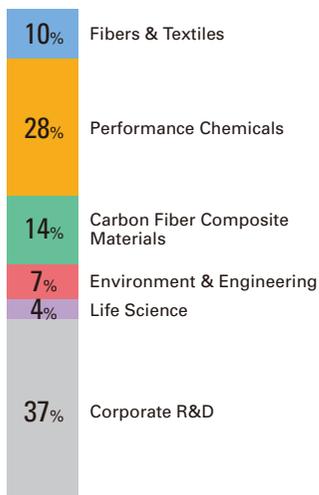
Fiscal 2020 R&D Expenditures (Billion yen)

62.8

R&D Expenditures (Billion yen)



Percentage
Breakdown of
Total R&D Expenditures
in Fiscal 2020



Fiscal 2020 R&D Achievements

Fibers & Textiles

Using NANODESIGN™, a proprietary conjugate spinning technology that enables free and highly precise control over the cross-sectional geometry of conjugate fibers, Toray developed Camifu™, a polyester filament textile that achieves the warmth and feel of hand-made Japanese paper. Camifu™ is environmentally-friendly, as one of its constituent polymers is made from recycled materials. The Company also developed the antiviral textile MAKSPEC™ V, which delivers exceptional washing durability and wearing comfort. In addition, Toray has developed LIVMOAT™4000, a single-use protective clothing that has the breathability to reduce stuffiness inside clothing while protecting wearers from dust and water.

Performance Chemicals

Toray has developed Ultra-Thin and Flexible Tough Polymers which retains the outstanding thermal resistance, elastic modulus and strength of polyamide 6 resin, while delivering an exceptional bending fatigue resistance 15 times higher than that of conventional polymers. The new material is expected to be used in automobiles, home appliances, and sports equipment with its superior bending fatigue resistance.

Toray has also created a non-porous separator for lithium-ion secondary batteries (LiBs) using lithium metal as the anode. By suppressing lithium dendrites formation and maintaining high ionic conductivity, the non-porous separator will increase the capacity and enhance the safety of Lithium Metal Anode Batteries.

Carbon Fiber Composite Materials

Toray has concluded an agreement with Lilium GmbH of Germany to supply carbon fiber composite materials for the Lilium Jet urban air mobility (UAM) vehicle that the company is developing. The development of the UAM, which is also referred to as a “flying car,” is progressing mainly in the small electric motors that will enable vertical takeoff and landing. Toray will help to resolve urban environmental issues by developing carbon fiber composite materials that cater to the unique challenges of UAM applications.

Toray has also jointly developed, with Tokyo-based MODEC, Inc., a carbon fiber reinforced plastic (CFRP)-based repair technology for oil and gas floating production, storage and offloading (FPSO) and floating storage and offloading (FSO) facilities. Approval for the technology as a repair method

for sections corroded by rust has been obtained from the American Bureau of Shipping.

Environment & Engineering

Toray developed a new polyvinylidene fluoride (PVDF) ultra-filtration (UF) membrane with exceptional virus removal rate and high water permeability for water treatment. Since the membrane effectively removes viruses and does not reduce water permeability, it can be expected to contribute to safe and economical water supplies—treated with minimal energy at low cost—in a wide range of water treatment fields, from food and beverages to wastewater reuse.

Life Science

A new concept antibody drug that is expected to be effective in treating many types of cancer, TRK-950 started Phase I clinical trials in the U.S.A. and France in March 2017. To date, the drug has been administered to more than 100 patients, and according to reports there have been no safety problems so far. The drug's safety and efficacy is being confirmed and the aim is to apply for approval as a cancer treatment drug at the earliest possible time.

Received Display Component of the Year Award for 2020

At the Society for Information Display (SID*), Toray received Display Industry Awards, the Display Component of the Year Award for its Spectrum Conversion by Organic Phosphor (SCO) sheet. This honor is in recognition of the sheet's significant contribution to the development of the display industry.

Toray has developed an organic luminescent material that exhibits sharp emission spectra and successfully commercialized the product. It is the world first organic luminescent material that helps liquid crystal displays to deliver high color gamuts, enabling colorful displays that cannot be rendered by conventional inorganic phosphors. SID highly appreciated the SCO sheet, because the sheet is composed of organic materials with environmentally-friendly technology and thus free of heavy metals and other toxic substances.

* Founded in 1962, SID is the world's largest academic society for electronic displays.

Received JCIA Technology Award for Anti-Thrombogenic Artificial Kidney

Toray received the 53rd JCIA Technology Award from the Japan Chemical Industry Association (JCIA) for developing and commercializing an anti-thrombogenic artificial kidney. This marked the sixth time for the Company to win that award, the previous occasion having been the 49th in fiscal 2016.

The need to enhance the anti-thrombogenic performance of artificial kidneys in line with advances in dialysis treatment is growing year by year. Given that situation, Toray was acclaimed for having fully drawn on its nanotechnology and computational chemistry capabilities in succeeding in commercializing an artificial kidney, a polysulfone membrane, with significantly improved anti-thrombogenic properties.

This development will lead to the commercialization of artificial kidneys to treat not only chronic but also acute renal failure, thereby contributing to improving patients' quality of life (QOL) and ease burdens on medical professionals.