BENEFITS AND RISKS OF ADVANCED BIOTECHNOLOGY APPLICATIONS

BENEFITS	APPLICATION	RISKS
Misdiagnoses plummet and healthcare outcomes improve.	**DIGITAL HEALTH / PERSONALIZED MEDICINE** — *Tailored medical treatments using AI to combine data from genetic sequencing, diagnostics, and biomonitoring.*	*Access disparities due to costs or location. Personal health data misuse or manipulation.*
Rapid, more effective medical treatments.	**ON DEMAND MEDICINE PRODUCTION** — *Cell-and gene-based therapies, combined with improvements in drug design and production, for faster disease response.*	*Disputes over R&D prioritization in developed vs. developing countries.*
Reduce delays and rejections of organ transplants and repairs.	**BIOPRINTING AND XENOTRANSPLANTATION** — *Additive manufacturing to "print" biological parts for medical testing or tissue replacement, grow human-compatible organs in animals for transplantation.*	*Access disparities due to the high up-front costs.*
Major reduction in inherited genetic diseases.	**REPRODUCTIVE ENGINEERING** — *Using genomic technologies to select and modify human embryos for broad range of traits and abilities.*	*Ethical and social divides over applications. Unequal access.*
Novel treatments for neurological disorders. Enhanced cognition and expanded perception.	**COMPUTER-HUMAN INTERFACES** — *Machine augmentation of human cognitive processes.*	*Tensions between augmented and non-augmented individuals. New cyber/bio vulnerabilities.*
Improved speed and reliability in designing and making novel materials, medicines.	**BIO-MANUFACTURING** — *Bio-design and production of enhanced or highly specified materials, medicines and foods.*	*Increased potential for misuse and workforce restructuring.*
Ready production of new and novel molecules, materials and treatments.	**SYNTHETIC ORGANISMS** — *Genetically modified organisms and biological processes create new materials and medicines.*	*Potential for weapons applications or accidental misuse. Unknown environmental impacts.*
Make barren or depleted lands productive. Mitigate human-induced and natural threats to the environment.	**ENVIRONMENTAL RESTORATION** — *Large-scale ecological intervention, through biotechnology, reforestation, or ocean engineering creates, manipulates, or rescues damaged environments.*	*Unintended, potentially global environmental or public health consequences.*
Practically unlimited capacity for long-term data storage.	**DNA-BASED DATA STORAGE** — *DNA used to encode and store data.*	*Increased potential for long-term social monitoring.*
Increased variety of cheaper, more nutritious foods created with lower environmental impact.	**TRANSFORMED AGRICULTURE AND FOOD PRODUCTION** — *Automated precision production processes and integrated crop-livestock systems use genetically altered organisms.*	*Reduced biodiversity, social tensions over genetic modification, workforce and supply chain disruptions.*