

Technology Area Taxonomy - Clean Deduplicated Structure

Canonical JetEngine taxonomy with one slug per parent and child term. Exact duplicates were removed and overlapping terms were consolidated to one primary technology category.

Normalization changes

- Organoids: kept only under Organ-on-Chip & Advanced Models.
- Hydrogels: kept only under Biomaterials.
- Scaffolds: consolidated as Medical-Grade Scaffolds under Biomaterials.
- Viral Delivery: removed from Drug Delivery; viral-vector technologies remain under Gene Therapy & Genome Engineering.
- Non-Viral Delivery: removed as a redundant broad Drug Delivery term; Non-Viral Gene Delivery remains under Gene Therapy & Genome Engineering.
- Engineered Cells: consolidated into Cellular Engineering under Synthetic & Engineering Biology; Engineered Immune Cells remains under Cell Therapy.
- Wound, Bone, Cartilage, and Vascular Regeneration: removed from Technology Area because they are therapeutic/application classifications and belong in the Therapeutic Area taxonomy.

Parent Technology Area	Parent Slug	Canonical Child Terms + Slugs
Regenerative Medicine & Tissue Engineering	regenerative-medicine-tissue-engineering	Stem Cell Technologies (stem-cell-technologies); iPSC Technologies (ipsc-technologies); Mesenchymal Stromal Cells (mesenchymal-stromal-cells); Hematopoietic Stem Cells (hematopoietic-stem-cells); Neural Progenitor Cells (neural-progenitor-cells); Cardiac Progenitor Cells (cardiac-progenitor-cells); Retinal/RPE Cells (retinal-rpe-cells); Engineered Tissues (engineered-tissues); Bioprinting (bioprinting); Decellularized Matrices (decellularized-matrices)
Cell Therapy	cell-therapy	CAR-T Cells (car-t-cells); TCR-T Cells (tcr-t-cells); CAR-NK Cells (car-nk-cells); NK Cell Therapies (nk-cell-therapies); Macrophage Therapies (macrophage-therapies); Dendritic Cell Therapies (dendritic-cell-therapies); Regulatory T Cells (regulatory-t-cells); Engineered Immune Cells (engineered-immune-cells); Allogeneic Cell Therapy (allogeneic-cell-therapy); Autologous Cell Therapy (autologous-cell-therapy)
Gene Therapy & Genome Engineering	gene-therapy-genome-engineering	CRISPR-Cas Systems (crispr-cas-systems); Base Editing (base-editing); Prime Editing (prime-editing); Gene Replacement (gene-replacement); Gene Silencing (gene-silencing); Viral Vectors (viral-vectors); AAV Vectors (aav-vectors); Lentiviral Vectors (lentiviral-vectors); Integration-Deficient Vectors (integration-deficient-vectors); Non-Viral Gene Delivery (non-viral-gene-delivery)
RNA Therapeutics	rna-therapeutics	mRNA (mrna); siRNA (sirna); miRNA (mirna); Antisense Oligonucleotides (antisense-oligonucleotides); Circular RNA (circular-rna); RNA Editing (rna-editing); RNA Delivery (rna-delivery)
Extracellular Vesicles & Cell-Derived Products	extracellular-vesicles-cell-derived-products	Exosomes (exosomes); Extracellular Vesicles (extracellular-vesicles); Secretome (secretome); Conditioned Media (conditioned-media); Engineered EVs (engineered-evs); EV Drug Delivery (ev-drug-delivery); EV Diagnostics (ev-diagnostics)
Protein & Antibody Therapeutics	protein-antibody-therapeutics	Monoclonal Antibodies (monoclonal-antibodies); Bispecific Antibodies (bispecific-antibodies); Multispecific Antibodies (multispecific-antibodies); Antibody-Drug Conjugates (antibody-drug-conjugates); Recombinant Proteins (recombinant-proteins); Enzyme Therapies (enzyme-therapies); Cytokines (cytokines); Growth Factors (growth-factors); Therapeutic Peptides (therapeutic-peptides); Protein Engineering (protein-engineering)
Molecular Diagnostics	molecular-diagnostics	PCR/qPCR (pcr-qpcr); Digital PCR (digital-pcr); NGS Diagnostics (ngs-diagnostics); Gene Panels (gene-panels); Liquid Biopsy (liquid-biopsy); Cell-Free DNA (cell-free-dna); Cell-Free RNA (cell-free-rna); Circulating Tumor DNA (circulating-tumor-dna); Molecular Pathology (molecular-pathology); Infectious Disease Molecular Testing (infectious-disease-molecular-testing)
Cellular Diagnostics	cellular-diagnostics	Flow Cytometry (flow-cytometry); Circulating Tumor Cells (circulating-tumor-cells); Cell-Based Assays (cell-based-assays); Immune Profiling (immune-profiling); Cytology Technologies (cytology-technologies); Single-Cell Diagnostics (single-cell-diagnostics)
Biomarkers & Precision Diagnostics	biomarkers-precision-diagnostics	Genomic Biomarkers (genomic-biomarkers); Transcriptomic Biomarkers (transcriptomic-biomarkers); Proteomic Biomarkers (proteomic-biomarkers); Metabolomic Biomarkers (metabolomic-biomarkers); Epigenetic Biomarkers (epigenetic-biomarkers); Immune Biomarkers (immune-biomarkers); Companion Diagnostics (companion-diagnostics); Predictive Biomarkers (predictive-biomarkers); Prognostic Biomarkers (prognostic-biomarkers)
Omics & Molecular Profiling	omics-molecular-profiling	Genomics (genomics); Transcriptomics (transcriptomics); Proteomics (proteomics); Metabolomics (metabolomics); Epigenomics (epigenomics); Single-Cell Omics (single-cell-omics); Spatial Transcriptomics (spatial-transcriptomics); Spatial Proteomics (spatial-proteomics); Multi-Omics (multi-omics)
Drug Delivery	drug-delivery	Lipid Nanoparticles (lipid-nanoparticles); Polymeric Nanoparticles (polymeric-nanoparticles); Liposomes (liposomes); Targeted Delivery (targeted-delivery); Intracellular Delivery (intracellular-delivery); Controlled Release (controlled-release); Localized Delivery (localized-delivery)

Parent Technology Area	Parent Slug	Canonical Child Terms + Slugs
Biomaterials	biomaterials	Bioactive Materials (bioactive-materials); Biodegradable Polymers (biodegradable-polymers); Injectable Biomaterials (injectable-biomaterials); Hydrogels (hydrogels); Nanomaterials (nanomaterials); Medical-Grade Scaffolds (medical-grade-scaffolds); Cell-Compatible Materials (cell-compatible-materials)
Drug Discovery & Therapeutic Screening	drug-discovery-therapeutic-screening	High-Throughput Screening (high-throughput-screening); Phenotypic Screening (phenotypic-screening); Target Validation (target-validation); Drug Repurposing (drug-repurposing); Organoid Screening (organoid-screening); Cell-Based Screening (cell-based-screening); Protein Screening (protein-screening); Functional Genomics (functional-genomics)
Microbiology & Anti-Infective Technologies	microbiology-anti-infective-technologies	Antimicrobials (antimicrobials); Antimicrobial Peptides (antimicrobial-peptides); Anti-Virulence Technologies (anti-virulence-technologies); Bacteriophages (bacteriophages); Host-Directed Therapies (host-directed-therapies); Microbiome Technologies (microbiome-technologies); Pathogen Detection (pathogen-detection); Antimicrobial Resistance Diagnostics (antimicrobial-resistance-diagnostics)
Vaccines & Immunization Technologies	vaccines-immunization-technologies	mRNA Vaccines (mrna-vaccines); Protein Vaccines (protein-vaccines); Viral-Vector Vaccines (viral-vector-vaccines); DNA Vaccines (dna-vaccines); Therapeutic Vaccines (therapeutic-vaccines); Cancer Vaccines (cancer-vaccines); Vaccine Adjuvants (vaccine-adjuvants)
Immunology & Immunomodulation	immunology-immunomodulation	Immune Modulators (immune-modulators); Innate Immunity (innate-immunity); Adaptive Immunity (adaptive-immunity); Cytokine Modulation (cytokine-modulation); Checkpoint Modulation (checkpoint-modulation); Immune Tolerance (immune-tolerance); Inflammatory Pathway Modulation (inflammatory-pathway-modulation)
Synthetic & Engineering Biology	synthetic-engineering-biology	Synthetic Gene Circuits (synthetic-gene-circuits); Engineered Microorganisms (engineered-microorganisms); Protein Design (protein-design); Directed Evolution (directed-evolution); Biosensors (biosensors); Cellular Engineering (cellular-engineering)
Organ-on-Chip & Advanced Models	organ-on-chip-advanced-models	Organ-on-Chip (organ-on-chip); Microphysiological Systems (microphysiological-systems); Organoids (organoids); 3D Cell Models (3d-cell-models); Disease Models (disease-models); Humanized Models (humanized-models)