Biotechnology & Health:

Key Developments in Biotechnology and Medicine:

Gene Editing Breakthroughs:

Personalized CRISPR Cures for Children: The Chan Zuckerberg Initiative (CZI) and the Innovative Genomics Institute (IGI) have announced the funding of a new Center for Pediatric CRISPR Cures. This center aims to advance and standardize personalized CRISPR-based gene editing therapies for severe pediatric genetic diseases, building on the success of treating "Baby KJ" with a custom CRISPR gene-editing therapy earlier this year.

CRISPR Market Growth: The global CRISPR gene editing market is projected to reach $4.77 billion in 2025, driven by technological advancements, increased investment in disease treatment, and demand for precise editing.

Novel Gene Editing Methods: Research continues to push the boundaries of CRISPR, with advancements in areas like:

CRISPR-based epigenome editing to generate androgenetic mice (from two sperm cells).

CRISPR-Cas9 screens identifying new therapeutic vulnerabilities in cancers (e.g., uveal melanoma, hepatocellular carcinoma).

Development of optically controlled CRISPR-Cas activity using photocleavable DNA, offering a universal and programmable approach.

New base editing tools like engineered Sdd7 cytosine base editors (CBEs) showing improved specificity and efficiency.

Application of CRISPR-Cas9 to deplete autoantigen proteins for autoimmune diseases.

CRISPR-Cas9 being explored to mitigate cellular senescence and age-related disease progression.

First Personalized Gene-Editing Therapy: The successful treatment of baby KJ with a base editing therapy for a fatal urea cycle disorder highlights the increasing precision and clinical application of gene editing, allowing for single-nucleotide mutation correction without double-strand breaks.

Delivery Systems for Gene Editors: Reviews are exploring the potential of inorganic and hybrid nanosystems (like gold and silica nanoparticles) as delivery vehicles for CRISPR-Cas9, offering advantages over viral and lipid-based systems.

AI in Healthcare - A Transformative Force:

Enhanced Diagnostics: AI is revolutionizing early disease detection, with platforms analyzing retinal images for heart, kidney, and eye diseases (e.g., Mediwhale's platform) and AI models accurately detecting early Parkinson's disease from brain imaging. Microsoft's MAI-DxO platform, an LLM-powered diagnostic tool, reportedly outperforms average physicians in accuracy.

Personalized Medicine: AI algorithms are tailoring treatment plans based on individual genetic makeup, medical history, lifestyle, and drug metabolism, making personalized

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medicine increasingly mainstream, especially for chronic conditions and cancer.

Drug Discovery & Clinical Trials: AI is accelerating drug discovery by analyzing vast datasets, simulating drug interactions, and optimizing clinical trials by identifying ideal participants and monitoring responses in real-time.

Virtual Health Assistants: AI-powered virtual assistants are becoming essential for patient engagement, offering 24/7 symptom checks, medication reminders, vital monitoring, and connecting patients to telehealth services.

Streamlining Administrative Workflows: AI is reducing the administrative burden on healthcare professionals by transcribing consultations, summarizing notes, and automating electronic health record updates.

Indian Initiatives: IIT Delhi, in partnership with TeamLease EdTech, has launched a comprehensive online executive program in AI in Healthcare, starting November 1, 2025, for working professionals. Pharma Global Capability Centers (GCCs) in India are leveraging AI to fast-track drug discovery and reduce R&D costs. AIIMS Patna is integrating AI-powered devices to enhance patient care.

New Drug Approvals (Recent approvals in late June/early July 2025):

Ekterly (sebetralstat): FDA approved on July 8, 2025, as the first and only oral on-demand treatment for hereditary angioedema (HAE).

Lynozyfic (linvoseltamab-gcpt): FDA granted accelerated approval on July 2, 2025, for relapsed or refractory multiple myeloma.

Zegfrovy (sunvozertinib): FDA granted accelerated approval on July 2, 2025, for non-small cell lung cancer with EGFR exon 20 insertion mutations.

Yeztugo (lenacapavir): FDA approved on June 18, 2025, as the first and only HIV prevention option offering 6 months of protection.

Several other approvals were noted for conditions like alkaptonuria, ADHD, binge eating disorder, bladder cancer, hypertension, and pain management. The first half of 2025 saw 7 novel oncology drug approvals by the FDA.

Cancer Research Breakthroughs:

Personalized Cancer Treatments: Tailored therapies based on a patient's genetic profile are becoming the new standard, showing higher success rates and fewer side effects in breast, lung, and colon cancers.

Cancer Vaccines: Development of personalized cancer vaccines that train the immune system to recognize and destroy cancer cells, both for prevention and recurrence, with promising trials in melanoma, ovarian, and bladder cancers. The UK's NHS is exploring trials of mRNA-based personalized cancer vaccines.

Early Detection Tests: Researchers have developed blood protein tests that can identify 18 early-stage cancers, showing high accuracy in initial screenings. AI-powered imaging and diagnostic tools are detecting cancers at earlier stages.

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Faster Treatments: A seven-minute cancer treatment jab (Atezolizumab/Tecentriq) is being introduced in England's NHS, significantly reducing administration time.

Precision Oncology: Focus on understanding the genetic and molecular characteristics of individual tumors to develop targeted treatments.

Infectious Diseases - Ongoing Challenges:

Persistent Threats: Infectious diseases remain a significant global public health challenge in 2025, driven by declining vaccination rates, antimicrobial resistance (AMR), climate change, and globalization.

Tuberculosis: Remains the world's leading infectious disease cause of death after briefly being surpassed by COVID-19, with over 10 million new cases annually, particularly in high-risk countries like India.

H5N1 Bird Flu: A looming threat with 81 confirmed human cases globally in 2024, and concerns rising due to cross-species transmission to dairy cattle and horses.

Measles Resurgence: A troubling comeback due to declining childhood vaccination rates.

Biotechnology Solutions: Companies like Integrated DNA Technologies are supporting infectious disease research with solutions such as next-generation sequencing and PCR.

Other Noteworthy Innovations:

Nanozyme for Blood Clotting: IISc (India) has developed a nanozyme to prevent abnormal blood clotting.

New Antibiotic Potential: Seven Actinobacteria strains have been found to inhibit pathogens, with diethyl phthalate identified as effective against Listeria monocytogenes.

Cryo-Electron Microscopy (Cryo-EM): This technology continues to advance understanding of diseases, aid in drug design, and study cell processes by freezing samples rapidly and using electron beams for detailed imaging.

MagIC Technology: A new method using tiny magnetic beads to pull together molecules for study, addressing challenges in detecting and analyzing biomarkers.

The landscape of biotechnology and health in mid-2025 is marked by rapid advancements, particularly in gene editing and AI, offering new avenues for personalized treatments, early diagnostics, and efficient drug development. However, persistent global health challenges like infectious diseases and the need for equitable access to these innovations remain critical areas of focus.

MCQS

1.What is the primary goal of the new Center for Pediatric CRISPR Cures funded by the Chan Zuckerberg Initiative (CZI) and the Innovative Genomics Institute (IGI)?

a) To develop new diagnostic tools for infectious diseases.
b) To advance and standardize personalized CRISPR-based gene editing therapies for severe pediatric genetic diseases.
c) To research new methods for drug delivery in adults.
d) To explore the use of AI in predicting genetic disorders.

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Answer: b) To advance and standardize personalized CRISPR-based gene editing therapies for severe pediatric genetic diseases.
The text states: "This center aims to advance and standardize personalized CRISPR-based gene editing therapies for severe pediatric genetic diseases, building on the success of treating 'Baby KJ' with a custom CRISPR gene-editing therapy earlier this year."

2. The global CRISPR gene editing market is projected to reach what value in 2025?
a) $1.5 billion
b) $2.8 billion
c) $4.77 billion
d) $7.2 billion

Answer: c) $4.77 billion
The text mentions: "The global CRISPR gene editing market is projected to reach $4.77 billion in 2025, driven by technological advancements, increased investment in disease treatment, and demand for precise editing."

3. The successful treatment of "Baby KJ" with a base editing therapy for a fatal urea cycle disorder is highlighted for its ability to:
a) Create double-strand breaks in DNA.
b) Perform single-nucleotide mutation correction without double-strand breaks.
c) Introduce entirely new genes into the patient's genome.
d) Induce cellular senescence for therapeutic purposes.

Answer: b) Perform single-nucleotide mutation correction without double-strand breaks.
The text emphasizes: "The successful treatment of baby KJ with a base editing therapy for a fatal urea cycle disorder highlights the increasing precision and clinical application of gene editing, allowing for single-nucleotide mutation correction without double-strand breaks."

4. Which of the following is NOT listed as a way AI is transforming healthcare, according to the provided text?
a) Enhanced Diagnostics
b) Manual data entry and paperwork
c) Personalized Medicine
d) Drug Discovery & Clinical Trials

Answer: b) Manual data entry and paperwork
While AI streamlines administrative workflows, it reduces manual data entry and paperwork, rather than being a way it transforms healthcare by doing manual data entry. The text highlights "Streamlining Administrative Workflows: AI is reducing the administrative burden on healthcare professionals by transcribing consultations, summarizing notes, and automating electronic health record updates."

5. IIT Delhi, in partnership with TeamLease EdTech, has launched a comprehensive online executive program in AI in Healthcare for working professionals starting on what date?
a) July 15, 2025
b) August 1, 2025
c) November 1, 2025
d) December 31, 2025

Answer: c) November 1, 2025
The text states: "IIT Delhi, in partnership with TeamLease EdTech, has launched a comprehensive online executive program in AI in Healthcare, starting November 1, 2025, for working professionals."

6. Which new drug, approved by the FDA on July 8, 2025, is noted as the first and only oral on-demand treatment for hereditary angioedema (HAE)?
a) Lynozyfic (linvoseltamab-gcpt)
b) Zegfrovy (sunvozertinib)
c) Ekterly (sebetralstat)

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d) Yeztugo (lenacapavir)

Answer: c) Ekterly (sebetralstat)
The text specifies: "Ekterly (sebetralstat): FDA approved on July 8, 2025, as the first and only oral on-demand treatment for hereditary angioedema (HAE)."

7. What condition is Yeztugo (lenacapavir), approved by the FDA on June 18, 2025, intended to prevent?
a) Multiple myeloma
b) Non-small cell lung cancer
c) Hereditary angioedema
d) HIV

Answer: d) HIV
The text states: "Yeztugo (lenacapavir): FDA approved on June 18, 2025, as the first and only HIV prevention option offering 6 months of protection."

8. What is a notable advancement in cancer treatment being introduced in England's NHS, significantly reducing administration time?
a) A new oral chemotherapy tablet.
b) A seven-minute cancer treatment jab (Atezolizumab/Tecentriq).
c) A self-administered nasal spray for cancer.
d) A robotic surgery procedure for all cancer types.

Answer: b) A seven-minute cancer treatment jab (Atezolizumab/Tecentriq).
The text highlights: "Faster Treatments: A seven-minute cancer treatment jab (Atezolizumab/Tecentriq) is being introduced in England's NHS, significantly reducing administration time."

9. After briefly being surpassed by COVID-19, which infectious disease remains the world's leading cause of death, with over 10 million new cases annually?
a) Measles
b) H5N1 Bird Flu
c) Tuberculosis
d) Malaria

Answer: c) Tuberculosis
The text states: "Tuberculosis: Remains the world's leading infectious disease cause of death after briefly being surpassed by COVID-19, with over 10 million new cases annually, particularly in high-risk countries like India."

10. What organization in India has developed a nanozyme to prevent abnormal blood clotting?
a) AIIMS Patna
b) IIT Delhi
c) Integrated DNA Technologies
d) IISc (Indian Institute of Science)

Answer: d) IISc (Indian Institute of Science)
The text mentions: "Nanozyme for Blood Clotting: IISc (India) has developed a nanozyme to prevent abnormal blood clotting."

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