

BIO MAKERS: SCIENCE & TECHNOLOGY

NEWS: Common biomarker for range of Cancers offers potential non-invasive method for early cancer diagnosis

WHAT'S IN THE NEWS?

Researchers have discovered common metabolites **across multiple cancer types, including** pancreatic cancer and glioma **(a type of brain and spinal cord cancer).** **These findings highlight the** potential for universal cancer biomarkers, **offering a** non-invasive approach for early cancer diagnosis and treatment strategies.

Understanding Biomarkers (Biological Markers)

1. Definition of Biomarkers

- A biomarker is a **measurable indicator of** biological processes occurring in cells or organisms.
- **These markers can be detected in** blood, bodily fluids, or tissues **and provide insights into** disease presence, progression, and treatment response.

2. Key Applications of Biomarkers

- **Disease Diagnosis:**
 - **Biomarkers provide a** non-invasive method **for detecting cancers and other diseases** at an early stage.
- **Personalized Medicine:**
 - **Helps in designing** tailored treatment plans **based on an individual's** genetic and molecular profile.
- **Monitoring Treatment Response:**
 - **Tracks how well a patient** responds to ongoing treatment, **helping doctors make adjustments for better outcomes.**

Need for Reliable Cancer Biomarkers

1. Challenges in Diagnosing Aggressive Cancers

- Pancreatic cancer and glioma **are among the most** aggressive cancers, **often diagnosed at** advanced stages **due to a** lack of early detection methods.
- Late-stage diagnosis **results in** poor survival rates and limited treatment options.

2. Urgent Need for Early Detection Mechanisms

- **Existing diagnostic tools are** invasive, costly, or inefficient **in detecting cancers early.**
- **A reliable** non-invasive biomarker **can revolutionize** cancer screening, diagnosis, and treatment planning.

3. Role of Exosomes as Cancer Biomarkers

- Exosomes, **also called** nano messengers, **are extracellular vesicles that** carry tumor-derived metabolites.
- **They serve as** indicators of metabolic changes **in the** tumor microenvironment (TME).

- **Exosomes provide a unique opportunity to explore the progression and characteristics of tumors.**

Breakthrough Research by INST Scientists

1. Research Conducted by Institute of Nano Science and Technology (INST)

- **Scientists from INST, Mohali (an autonomous institute under the Department of Science and Technology (DST)) have made a major breakthrough in cancer biomarker identification.**
- **Their research focused on metabolites present in exosomes derived from multiple cancer types, including pancreatic, lung, and glioma cancer cell lines.**

2. Discovery of Universal Cancer Biomarkers

- **The researchers successfully identified common metabolites across different cancer types, indicating the possibility of universal cancer biomarkers.**
- **These metabolites can be used to develop non-invasive diagnostic tools that can detect cancer at an early stage.**

3. Potential Impact of the Research

- **The discovery could enhance the clinical applicability of exosome-based diagnostics in oncology.**
- **The identified metabolites may also serve as therapeutic targets, paving the way for more effective cancer treatments.**

Advanced Multi-Technique Approach Used in the Study

1. Comprehensive Analysis of Exosomes

- **Unlike previous studies that relied on single-method approaches, the researchers used a multi-technique strategy to gain in-depth insights into exosome characteristics.**

2. Techniques Employed in the Study

- **Nanoparticle Tracking Analysis (NTA):**
 - **Measured the size and concentration of exosomes in biological samples.**
- **Electron Microscopy (EM):**
 - **Provided high-resolution imaging to study the structural details of exosomes.**
- **Western Blot (WB):**
 - **Used to identify specific proteins within exosomes, confirming their role in cancer.**
- **Fourier Transform Infrared Spectroscopy (FTIR):**
 - **Helped detect biochemical changes in exosomes based on infrared absorption patterns.**
- **Untargeted Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS):**
 - **Analyzed metabolic profiles in exosomes, identifying potential biomarkers.**
- **Nuclear Magnetic Resonance (NMR):**

Provided a detailed molecular fingerprint of metabolites in cancer-derived exosomes.

3. Significance of Using Multiple Techniques

- **This approach** eliminates the limitations of **conventional single-method studies**.
- **It provides** comprehensive insights into tumor metabolism, **enhancing the accuracy and reliability of biomarker identification**.

Impact on Cancer Diagnosis and Treatment

1. Understanding Dysregulated Pathways in Cancer

- **The identified metabolites** reveal abnormal metabolic changes in the tumor microenvironment (TME).
- **These findings help scientists understand** how cancer cells survive, grow, and spread.

2. Potential for Non-Invasive Cancer Detection

- **Since these metabolites can be detected in** bodily fluids (e.g., blood, urine, saliva), **they provide a non-invasive alternative** to traditional biopsies.
- **This discovery increases the chances of early cancer detection, improving survival rates.**

3. Enhancing Targeted Therapies

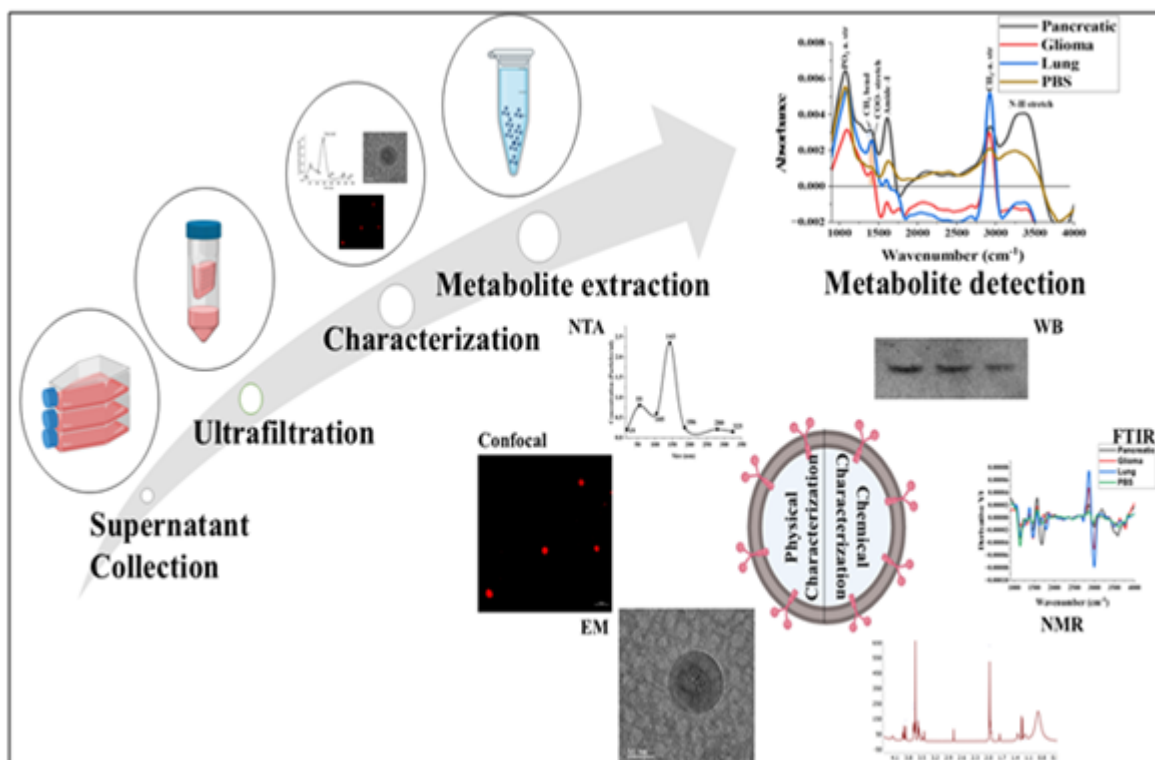
- **By studying the** metabolic alterations in tumors, **researchers can develop** personalized treatment plans **targeting specific metabolic pathways**.
- **This improves** treatment effectiveness **while** reducing side effects.

4. Contribution to Precision Medicine

- **The study supports** precision medicine approaches, **where cancer treatment is tailored** based on an individual's unique biological markers.
- **Personalized treatments lead to** better patient outcomes and long-term survival rates.

5. Future Prospects for Clinical Application

- **The research has been published in the journal Nanoscale, gaining international recognition.**
- **It lays the foundation for developing diagnostic kits and targeted therapies for various cancers.**



Key Takeaways from the Study

1. Landmark Discovery in Cancer Biomarker Research

- **Researchers identified** universal metabolites **across different cancers, which could revolutionize** early detection and treatment strategies.

2. Multi-Technique Approach Ensures Higher Accuracy

- **The use of** advanced analytical techniques **makes the findings** more reliable and clinically applicable.

3. Potential to Improve Cancer Survival Rates

- Early and non-invasive detection **can** significantly improve survival rates, **especially for aggressive cancers like** pancreatic and glioma.

4. Towards a New Era in Cancer Treatment

- **The study supports** precision medicine, **which can enhance treatment effectiveness while minimizing side effects.**

5. Future Research and Clinical Trials

- **Further research and clinical validation will be necessary to** implement these biomarkers in real-world cancer diagnostics.

Conclusion

- **The** identification of universal cancer biomarkers **is a major breakthrough in oncology.**
- **The study provides** new hope for patients **with** aggressive cancers like pancreatic and glioma, **which currently have** limited treatment options.
- **With continued advancements,** exosome-based biomarker detection **could become** a standard tool for early cancer diagnosis and personalized treatment.

Source: <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2104995>