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4th International Conference

on

Proteomics & Bioinformatics

August 04-06, 2014 Hilton-Chicago/Northbrook,

Chicago, USA



- ▶ I am currently a research assistant and Ph.D in Turkey.
- ▶ I received my Master's in Molecular Biology and Genetics.
- ▶ I have focused on proteomics that detect new potential cancer protein biomarkers in my Ph.D thesis.
- ▶ Now I am at Texas A&M University, working in the Laboratory for Biological Mass Spectrometry as an invited researcher.
- ▶ I have received scholarships for my MSc and Ph.D from TUBITAK, which is the best research center in Turkey.

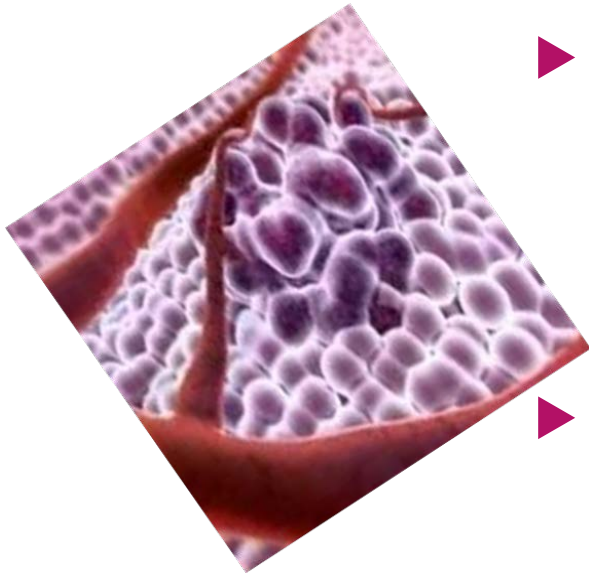


Application of Nanobiotechnology in Oncoproteomics

Sevgi Gezici, Mehmet Ozaslan

Texas A&M University, Laboratory For Biological Mass Spectrometry, College Station, 77843, TX

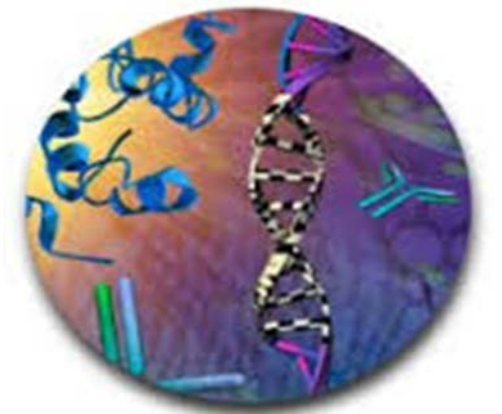
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- ▶ Why have we selected this topic?
 - ▶ What is the importance of this topic?

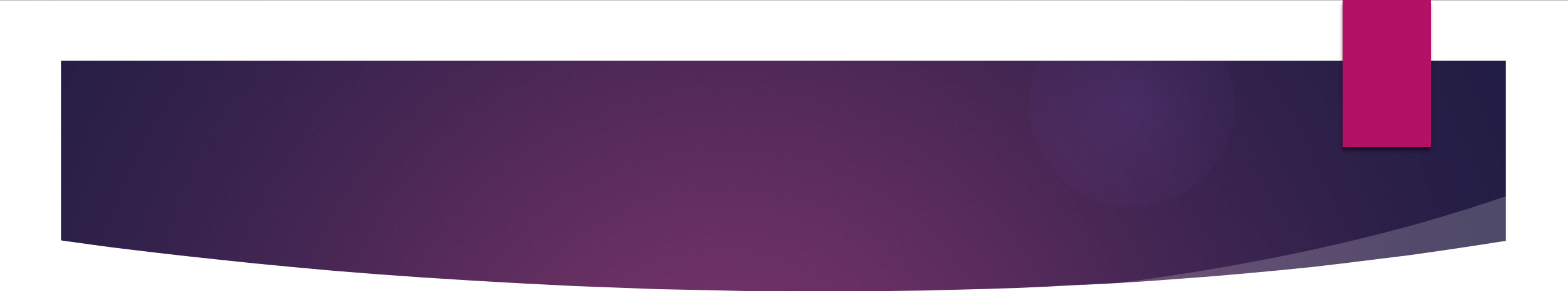


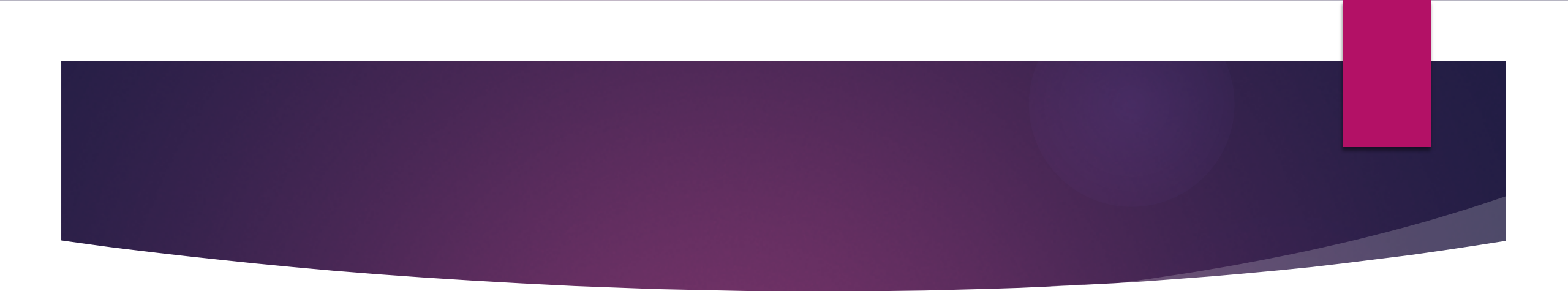
- ▶ It is well known that in recent years **cancer** is one of the disease that causes the leading of **death in the worldwide**.
- ▶ **Successful cancer treatment** depends not only on better therapies but also on improved methods to assess an individual's risk of developing cancer and to detect cancers at early stages when they can be more effectively treated

- ▶ It is advantageous to use **proteins** in order to improve effective methods.
- ▶ In the effective **oncoproteomics researchs**, researchers have to analysis all of the proteins such as small proteins, big proteins, low abundance proteins.....

But it is not possible to detect all of the proteins.

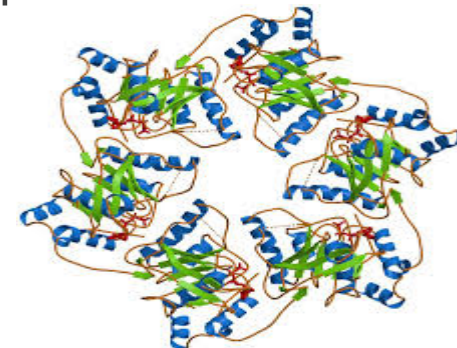


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- ▶ In this situation **nanoproteomics analysis** which is used nanoparticles, are important for oncology
 - ▶ **The application of nanoproteomics** gives the opportunity to eliminate death and suffering from cancer

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- ▶ **Nanotechnology** has recently built a technical platform to improve biocompatibility, specificity, reproducibility, and robustness of proteomic analysis.
 - ▶ **Nanotechnologies convert microarrays into nanoarrays** to overcome the detection limit.
 - ▶ **Nanomaterials** can significantly improve the quality of proteomics by manipulating individual proteins.

Nanotechnology → Nanobiotechnology → Nanoproteomics

- ▶ **Nanotechnology** is the creation and utilization of materials, devices and systems through the control of matter on the nanometer scale.
- ▶ **Nanobiotechnology**----- If it is used and applied for living cell Nanobiotechnology are being used to improve drug discovery, drug delivery, pharmaceutical manufacturing and molecular diagnosis.
- ▶ **Nanoproteomics**; is a new proteomics technology that is an application of nanobiotechnology to proteomics. It is an extension of the scope of proteomics on nanoscale.



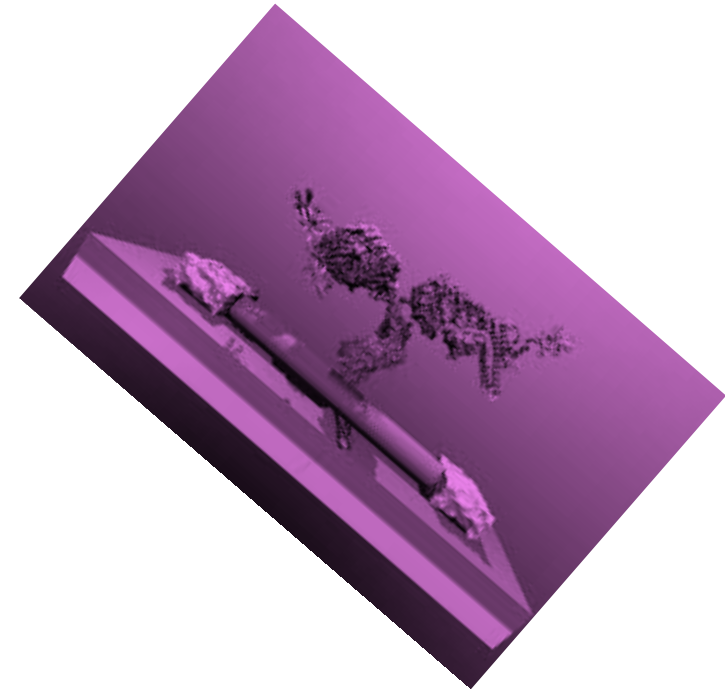
Nanoproteomics → Oncoproteomics

- ▶ **Oncoproteomics** is the term used for application of proteomic technologies in oncology
- ▶ **Oncoproteins** are biomarkers for cancer.

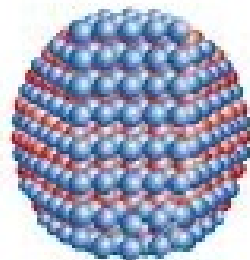
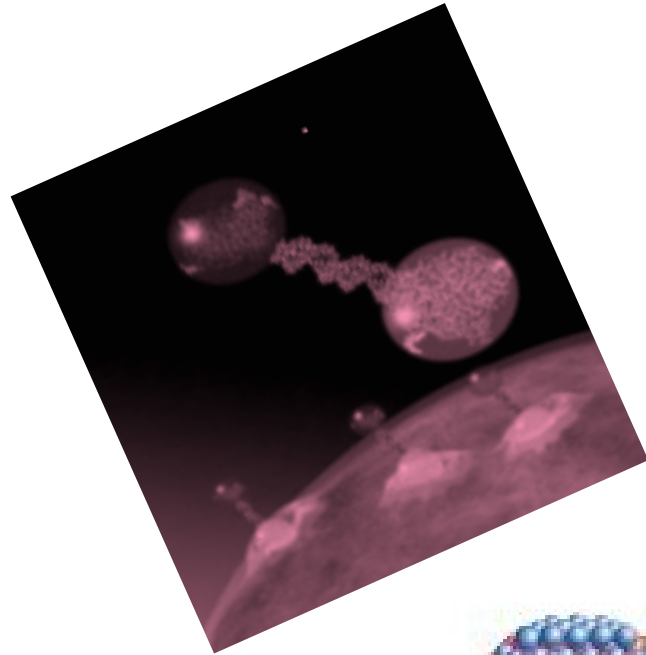


▶ Nowadays, **cancer-related nanoproteomics** play a pivotal role by contributing to the development of oncoproteomics, such as

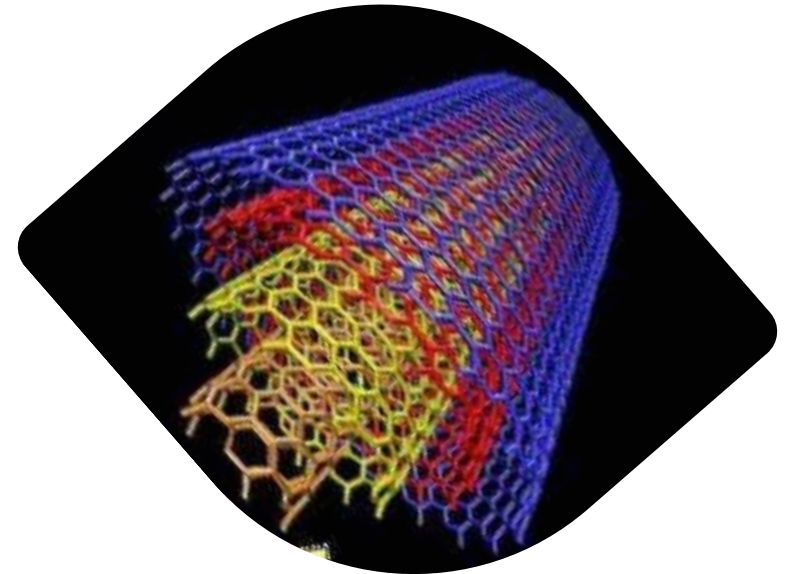
- ▶ cancer diagnosis,
- ▶ detecting cancer and its location in the body,
- ▶ cancer treatment,
- ▶ delivering anti-cancer drugs, and
- ▶ cancer prevention.



Different nanotechnological applications have been applied to complement proteomics, including



- ▶ functionalized nanoparticles,
- ▶ gold nanoparticles,
- ▶ silicon nanowires,
- ▶ carbon nanotubes (CNTs),
- ▶ nonporous structures,
- ▶ quantum dots and
- ▶ polymeric nanostructures



Why does oncoproteomics need nanotechnology? What is the importance of nanoproteomics?

Proteomics has detection limit:

- ▶ It is still impossible to detect all protein molecules existing in a biological material
- ▶ It is difficult to detect of low abundant proteins in the presence of high abundant proteins

Combining nanotechnology with proteomics can provide many advantages:

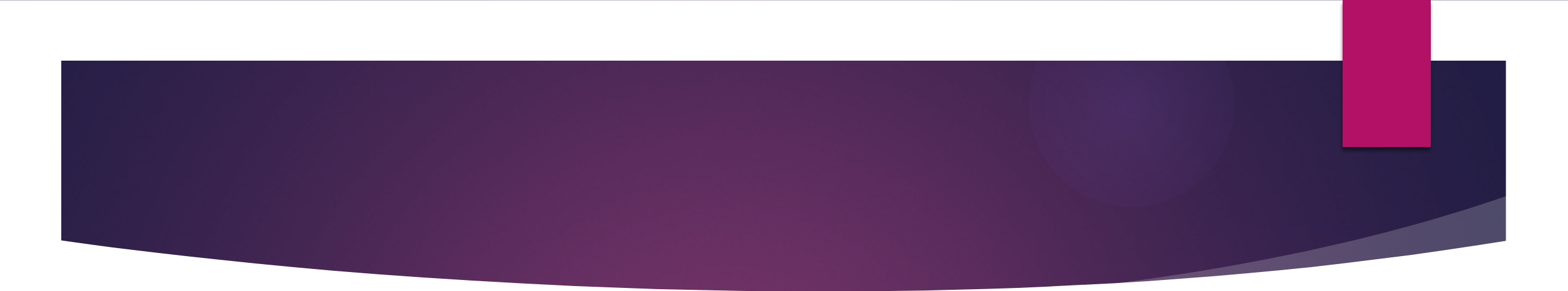
- ▶ Individual protein manipulation,
- ▶ ease of mass transfer through nanomaterial large surface-to-volume ratio,
- ▶ enhanced separation efficiency,
- ▶ enhanced high throughput capability,
- ▶ reduced assay time,
- ▶ reduced sample consumption, and
- ▶ ultralow detection limits





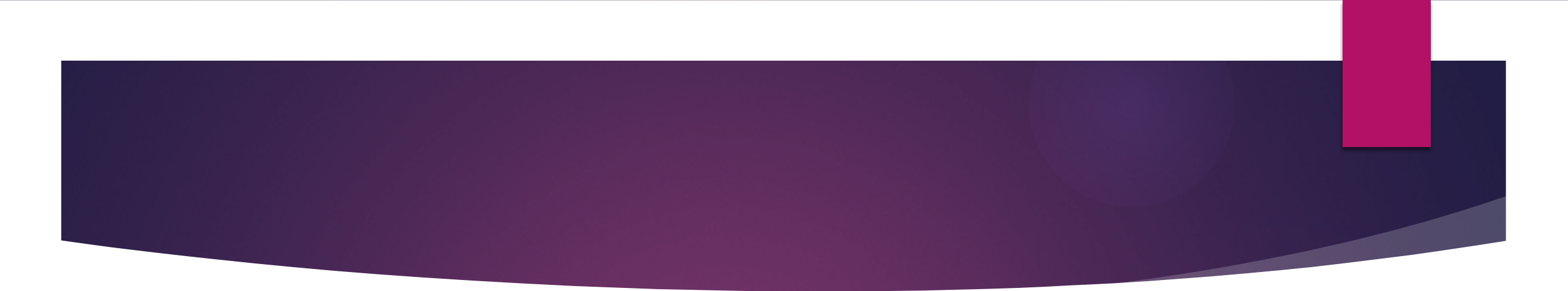
So oncoproteomics needs new
technologies

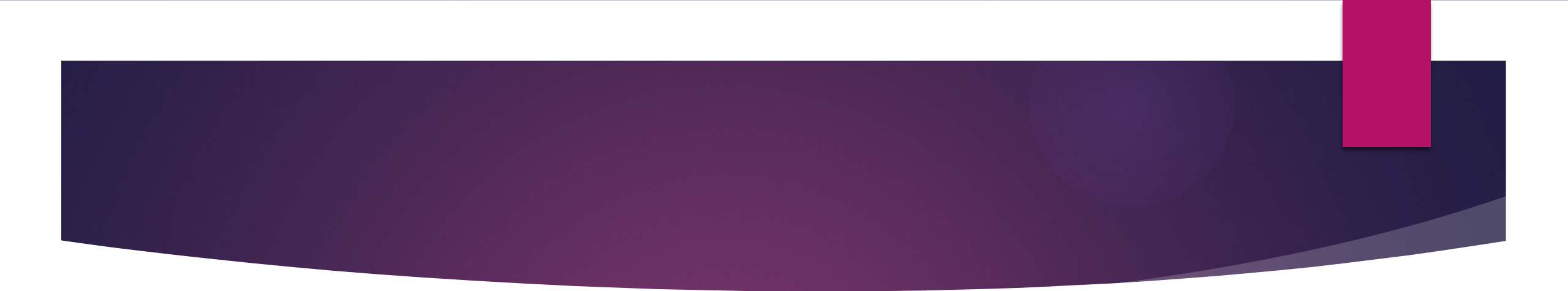
Nanoproteomics

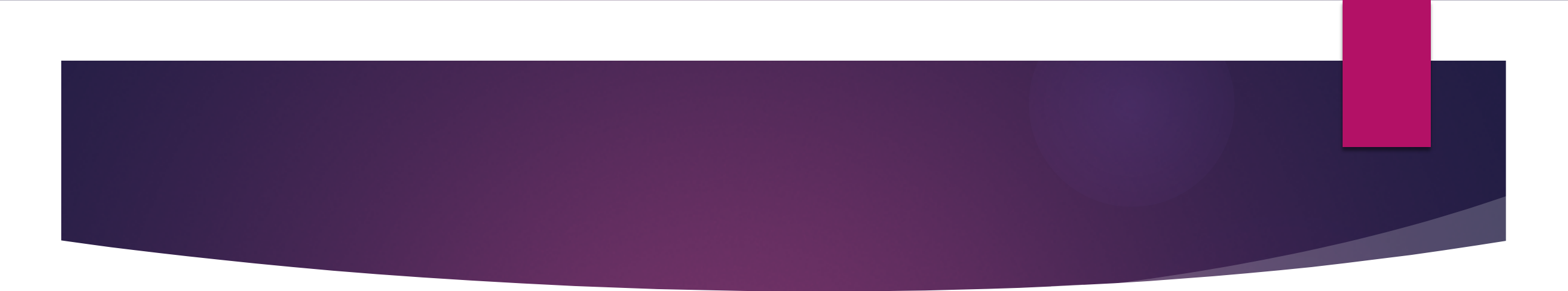
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- ▶ Researches have shown that nanoproteomics has the potential to dramatically increase the effective and fast oncoproteome analysis by using nanoparticles.
 - ▶ It can be subjected to nanoscale proteins that may exclusively be isolated from biopsies of tumors and then can be analyzed by different nanoproteomics methods.

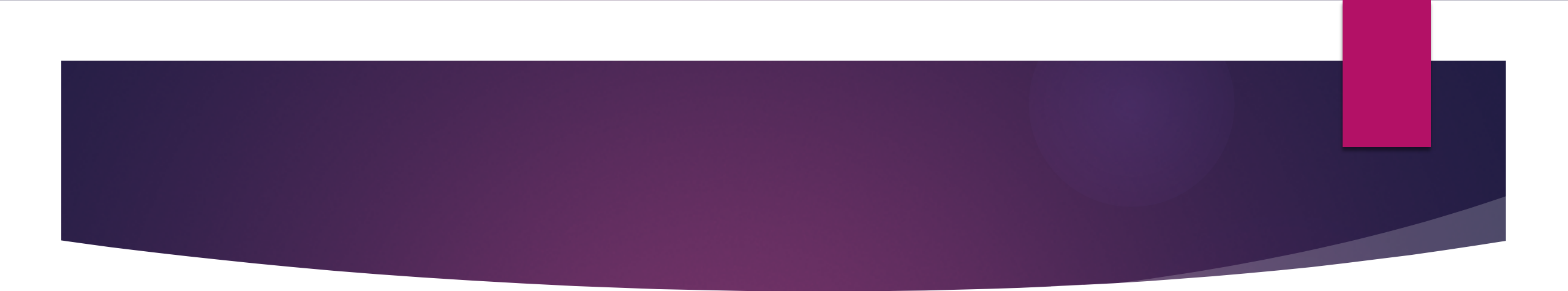
Some Nanoproteomics Methods

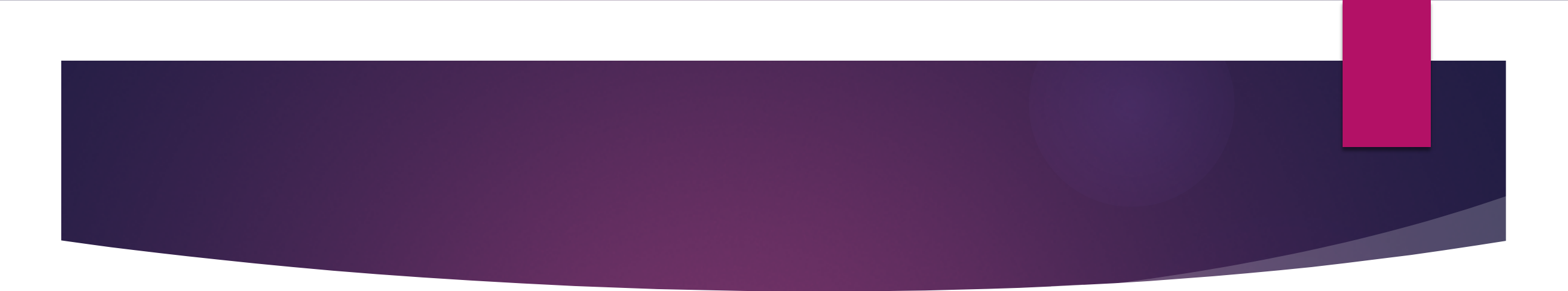
- ▶ **FAIMS (High-field asymmetric waveform ion mobility mass spectrometry)** with electrospray and nanoelectrospray MS is an ion mobility technology that has been used in ion separation in determination of low abundance peptide ions from cancer samples.

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- ▶ **Nanoflow Liquid chromatography (nanoLC)** combined with electrospray ionization mass spectrometers and tandem mass spectrometers is sensitive in identifying gel-separated cancer proteins and peptides.

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- ▶ The use of **liquid chromatography (LC)** in analytical chemistry is well established but the relatively low sensitivity associated with conventional LC makes it unsuitable for the analysis of certain biological samples.
 - ▶ Furthermore, standard LC flow rates are frequently not compatible with the use of specific detectors, such as electrospray ionization mass spectrometers.

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- ▶ Therefore, due to the analytical demands of biological samples, miniaturized LC techniques were developed to allow for the analysis of samples with greater sensitivity than that afforded by conventional LC. In **nanoflow LC (nanoLC)**, chromatographic separations are performed using flow rates in the range of low nanoliter per minute, which result in high analytical sensitivity due to the large concentration efficiency afforded by this type of chromatography.

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- ▶ In addition to this, gel-free approaches in combination with nanoLC and LC have been advanced to perform faster and more comprehensive proteome analysis.

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- ▶ Also LC-MS/MS (**nanoflow liquid chromatography-mass spectrometry**) analysis has been developed to expand the identification of low abundance peptide and increase reliable peptide sequencing information for targeted oncoproteomics.

In conclusion

Developing nanoproteomics technology using nanoparticles in the field of cancer is very important because studies show that it is able to detect low abundance proteins which would be highly difficult to obtain otherwise.

Nanoproteomics is still developing and will have a major influence in the future.

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Thank you





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