UNIVERSITE PIERRE & MARIE CURIE
LA SCIENCE A PARIS

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

PNA fragmentation

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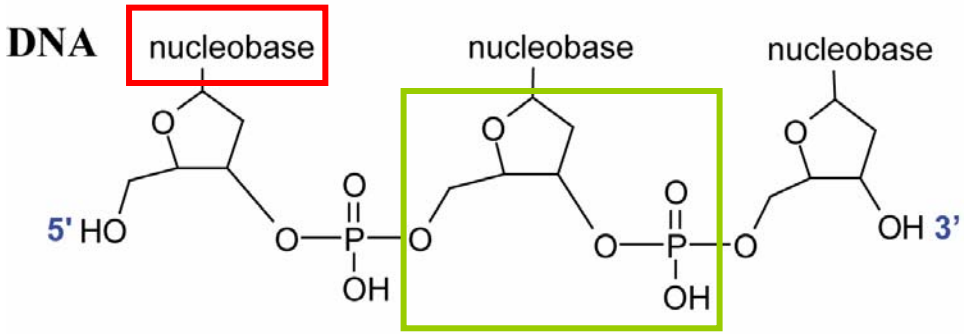
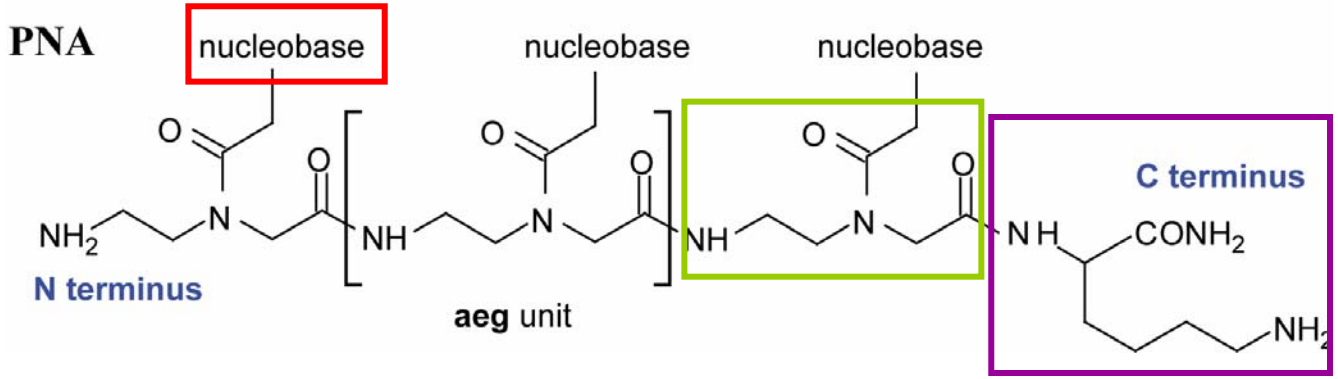
1. Introduction

What are PNA oligomers ?

« natural » oligomers



artificial oligomers
Nielsen et al.[6]



6. Nielsen P.E. et al. *Science*. 1991, 254, 1497.

2. Methods

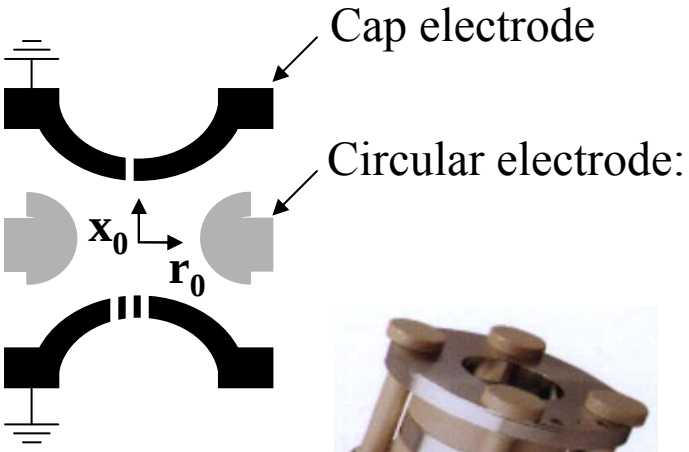
Ion trap → **Dissociation under low energy conditions** ← **FT-MS**

Sources: nano- and electrospray

Solvent = water/methanol 1/1 + 1% TEA

Esquire 3000™ (Bruker)

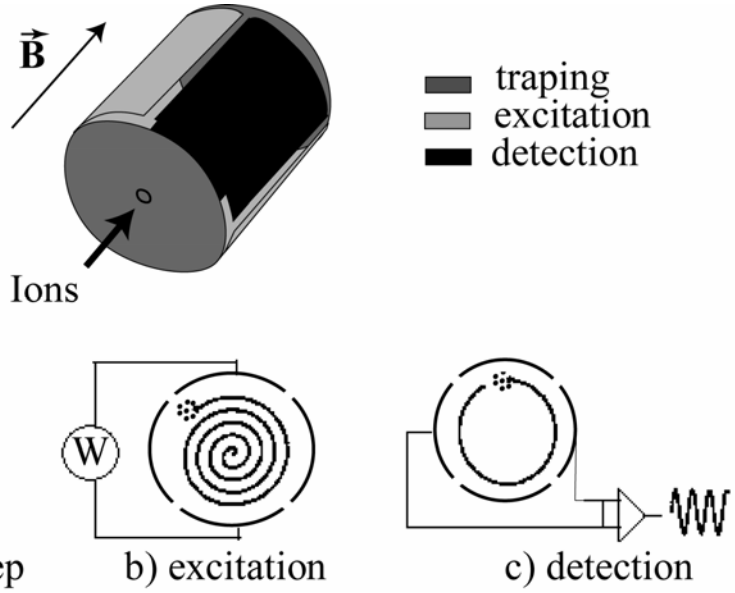
- Space charge
- Low Mass Cut Off



Bruker™ ion trap

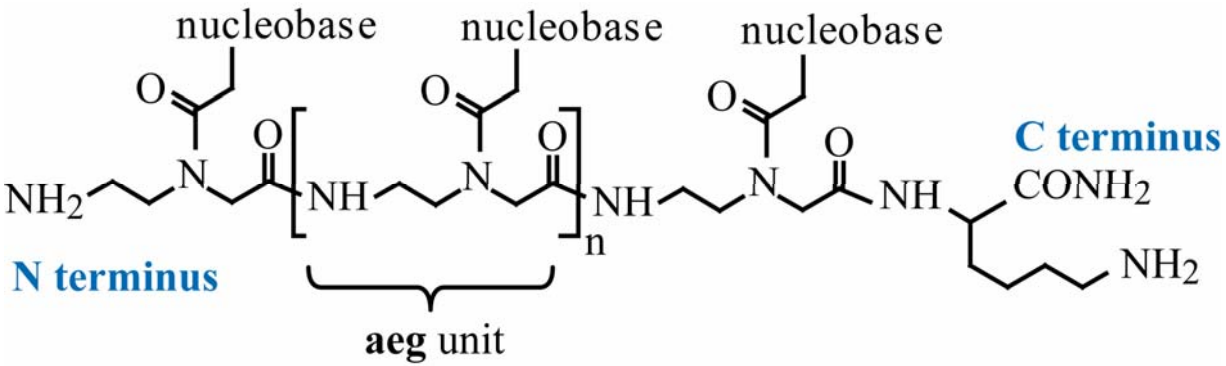
Apex-Qe™ (Bruker)

+ Very high resolution
+ Accurate mass measurement

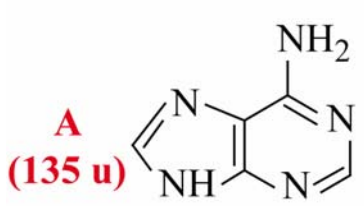


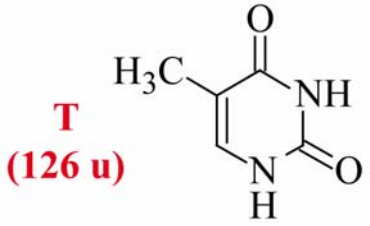
3. Results

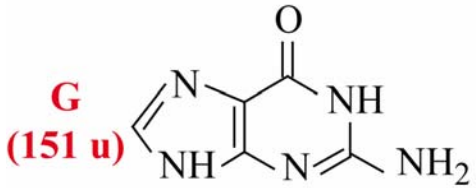
What kind of oligomers ? Various sequences !

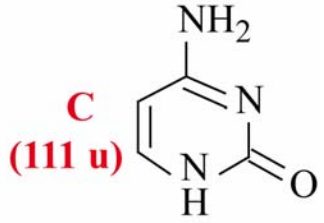


Sequence ($N_{terminal} \rightarrow C_{terminal}$)	Mw	Nomenclature
GTA GAT CAC T-Lys	2855	P_{58}
AGT GAT CTA C-Lys	2855	P_{60}
AGG TAA CGA G-Lys	2929	P_{2482}
CTC GTT ACC T-Lys	2782	P_{2484}







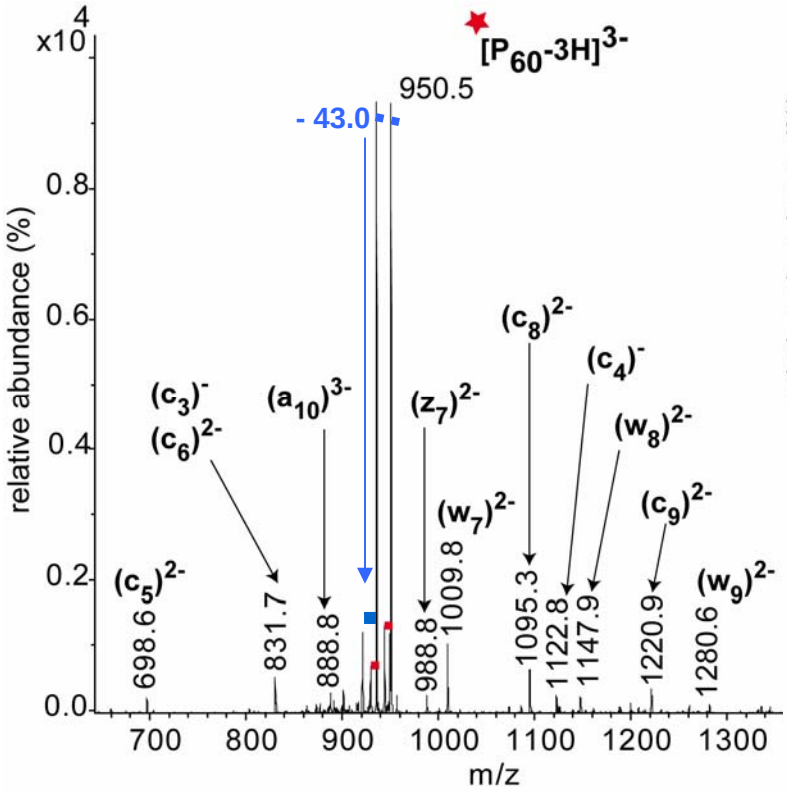


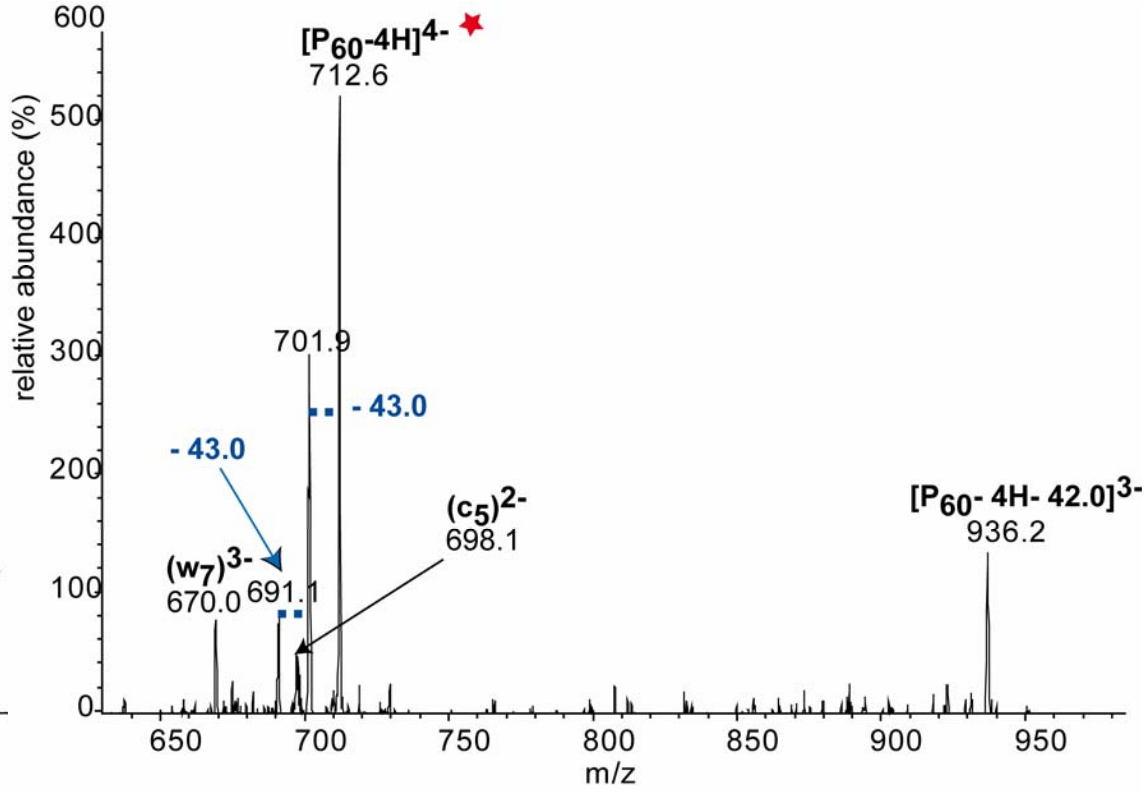
3. Results

What kind of product ion using an ion trap ?

Low charge state: - sequence ions
- 43 u losses

High charge state : - ~~sequence ions~~
- 43 u and 42 Th losses

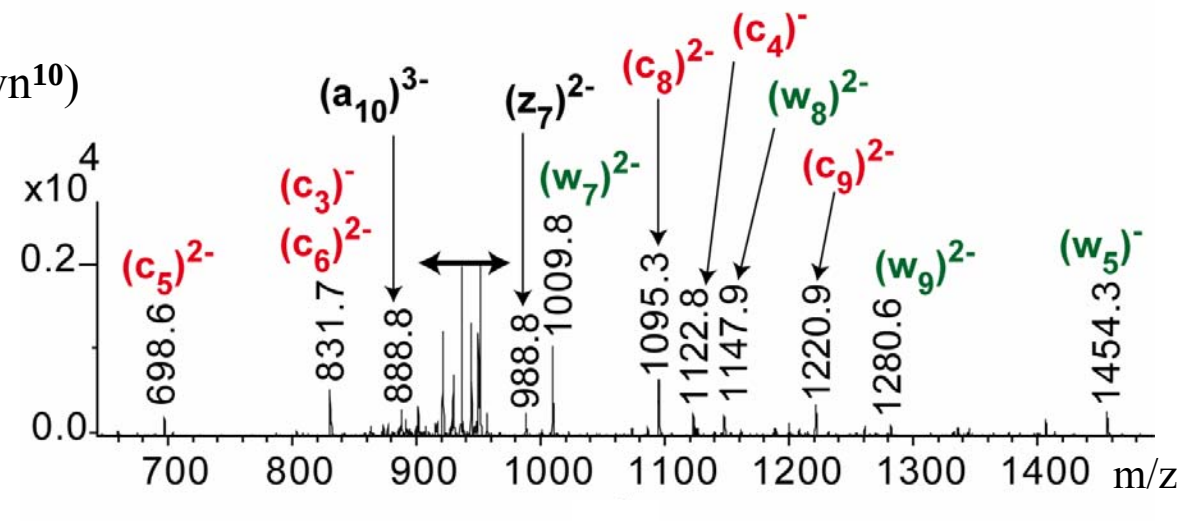


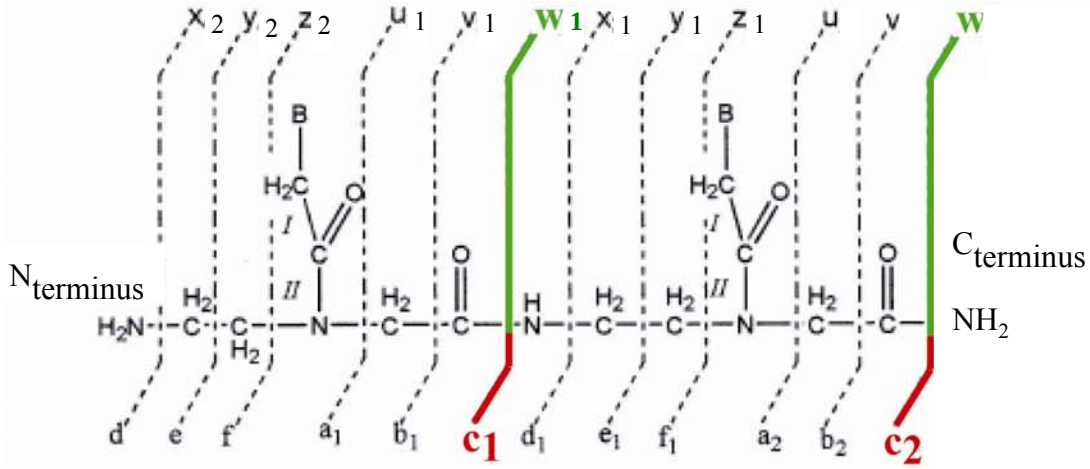


precursor ion water loss loss of 43 u

Low charge state: sequence ions

Product ions: c_i and w_i (known[10])





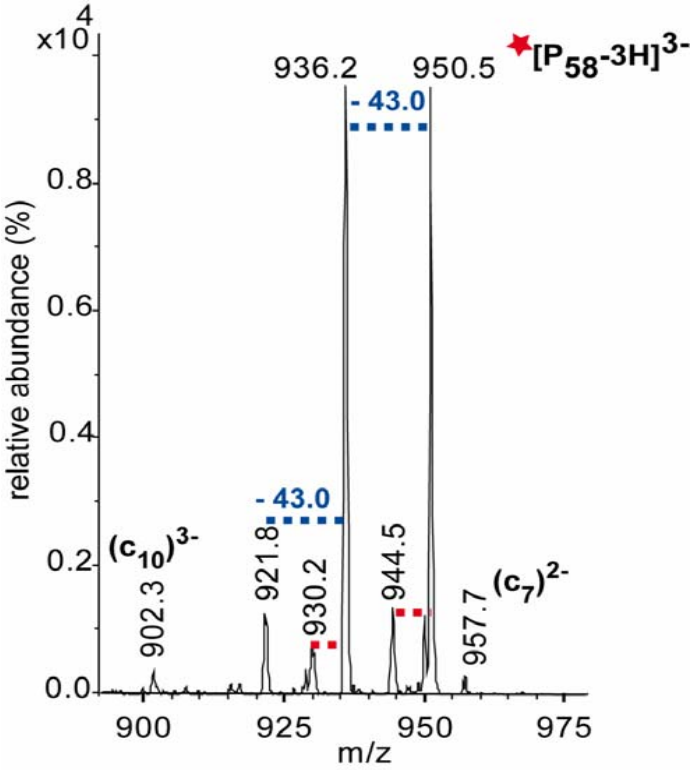
10. Flora J.W. et al. *J. Am. Soc. Mass Spectrom.* 2000, 11, 615.

3. Results

Which structure for the fragment of 43 u ?

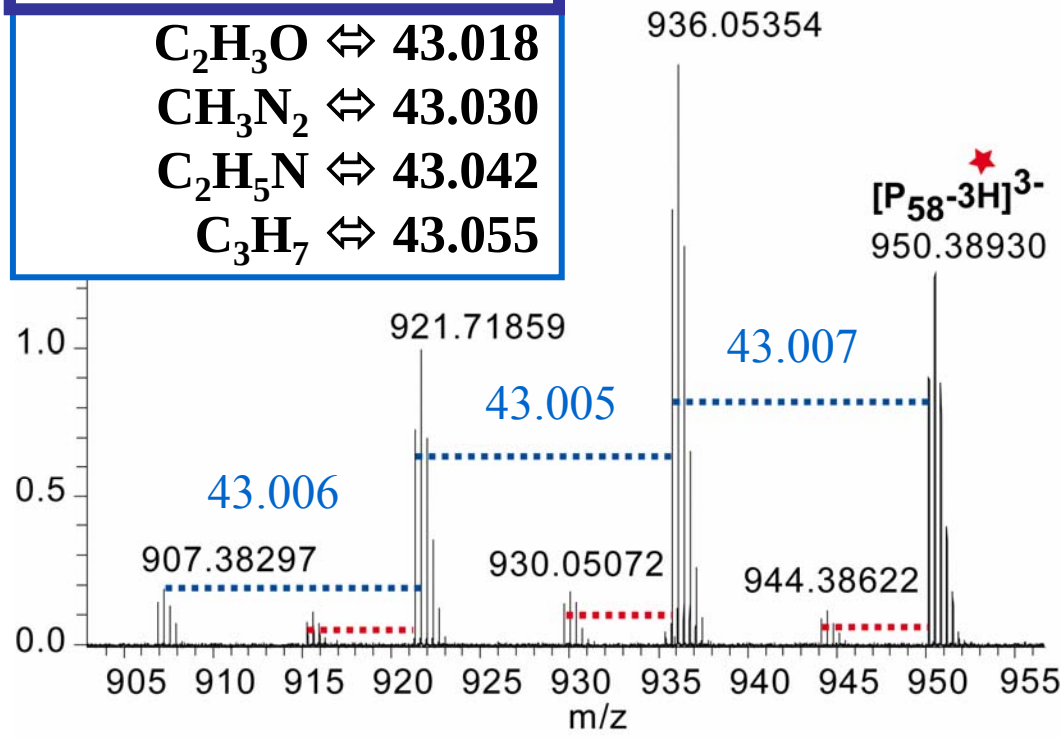
FT-ICR ⇨ elementary composition.

Ion trap



FT-ICR

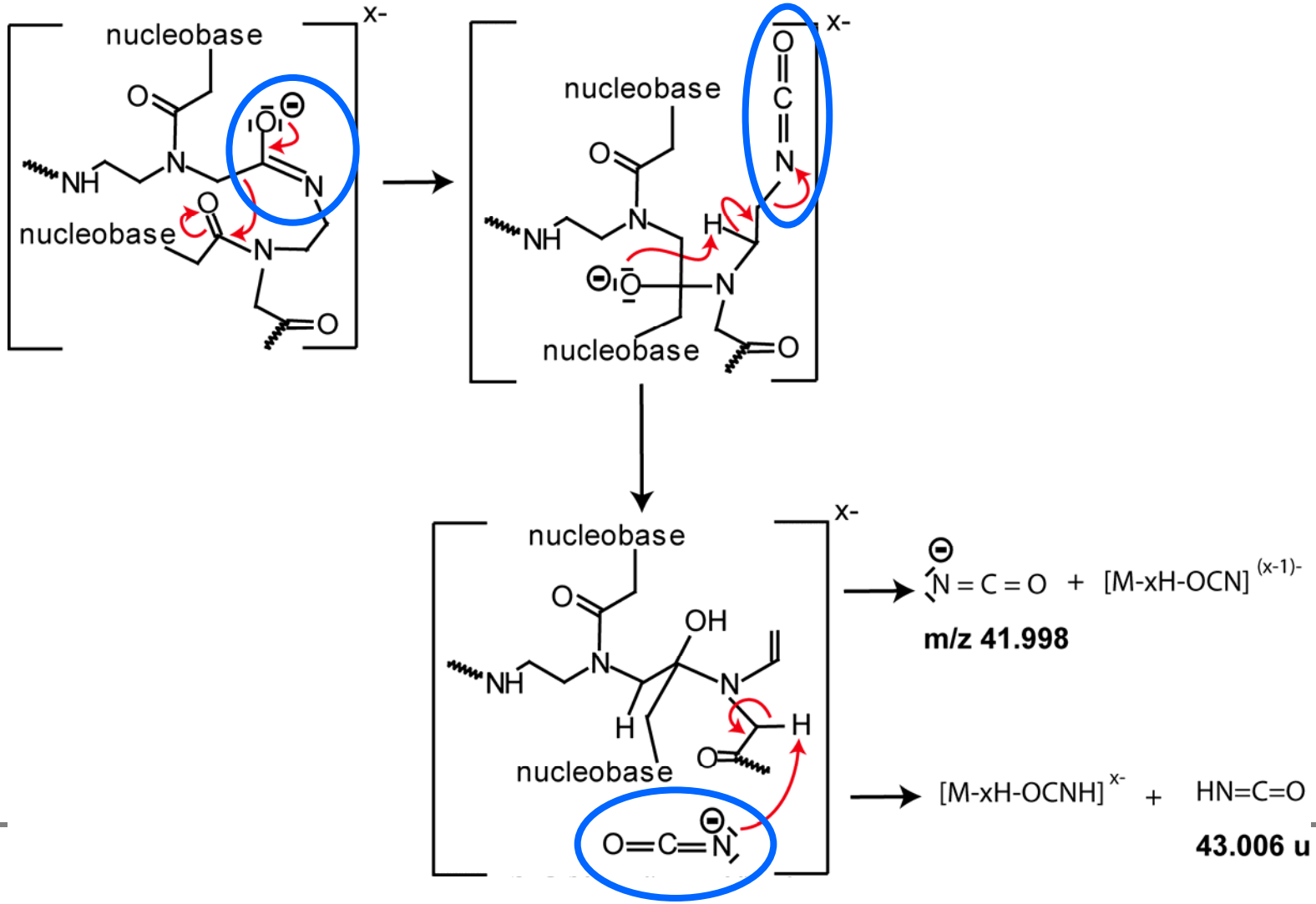
O = C = NH ⇔ 43.006
C_2H_3O ⇔ 43.018
CH_3N_2 ⇔ 43.030
C_2H_5N ⇔ 43.042
C_3H_7 ⇔ 43.055



precursor ion water loss loss of 43 u

3. Results

Which mechanism for the formation of O=C=NH ?



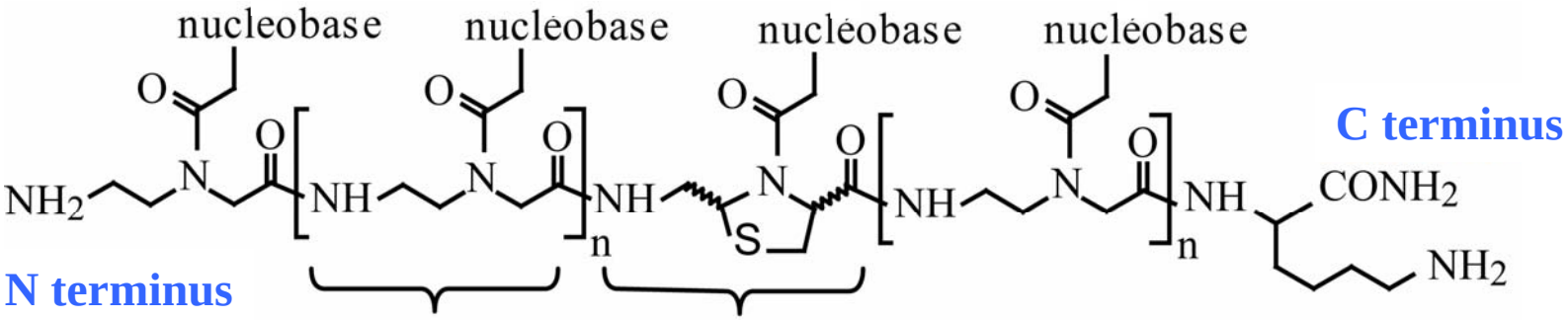
3. Results

« Modified PNA »

Which product ions for these PNA in an ion trap ?

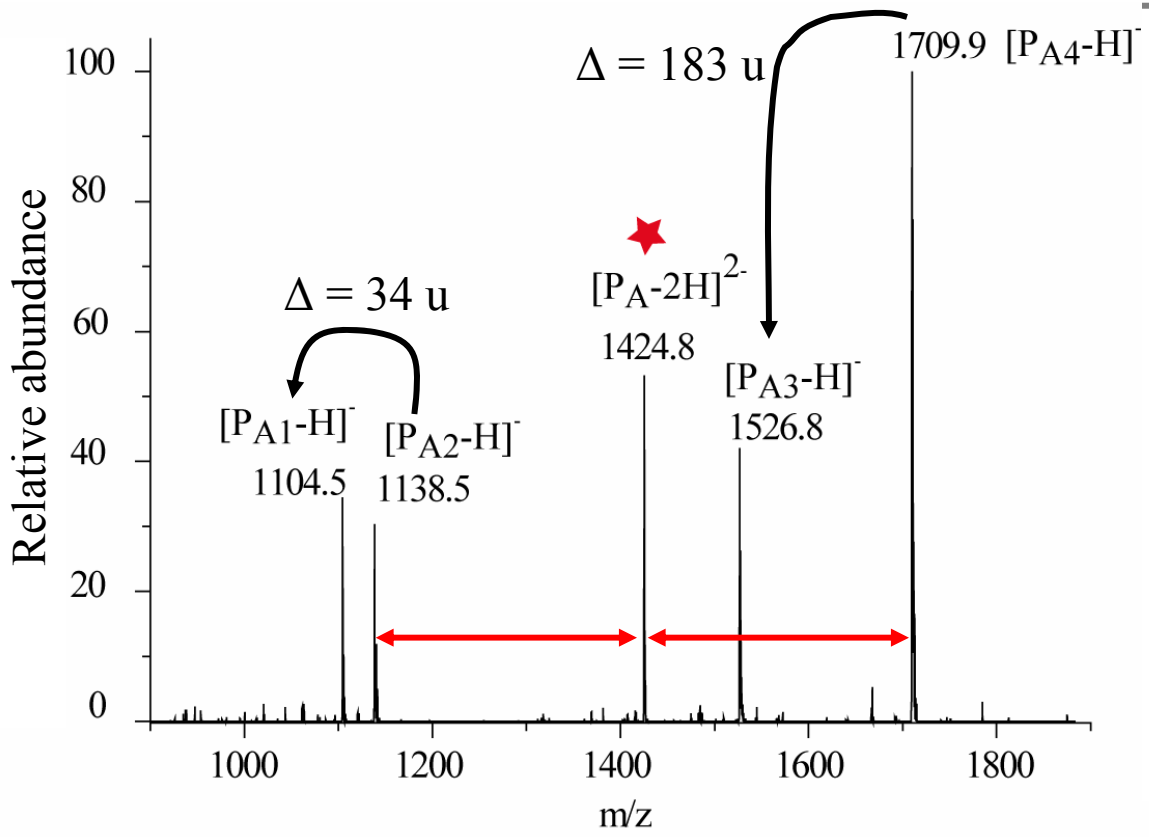
Sequence ($N_{terminus} \rightarrow C_{terminus}$)	Mw	Name
TTT TTT TTT T-Lys	2802	P_N
TTT TT_ST TTT T-Lys[a)]	2847	P_S
TTT TT_AT TTT T-Lys[b)]	2847	P_A

a) T_S : modified unit / **amt** *syn* **b)** T_A : modified unit / **amt** *anti*

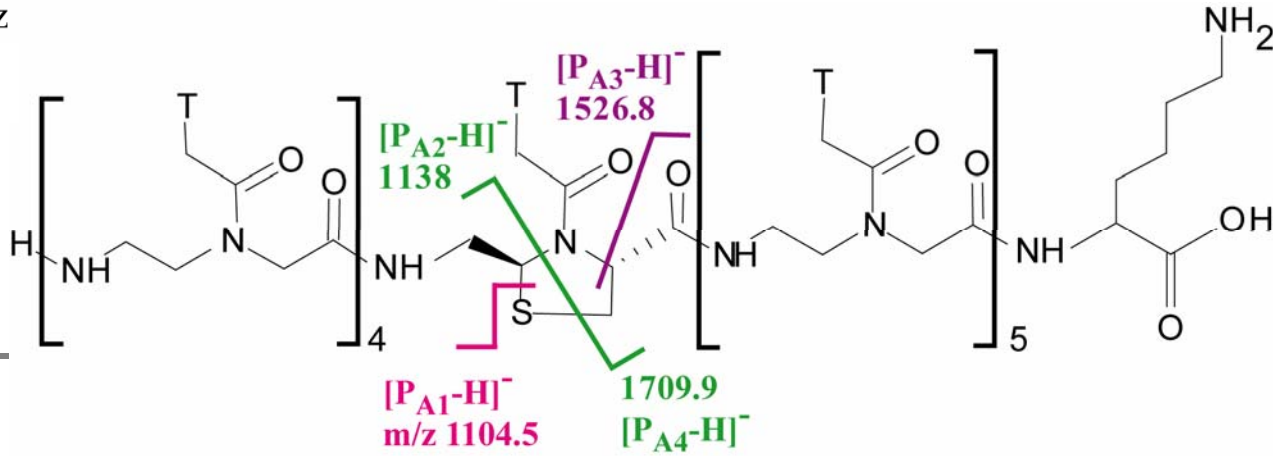


6. Bregant et al. Eur. J. Org. Chem. 2001, 17, 3285.

3. Results

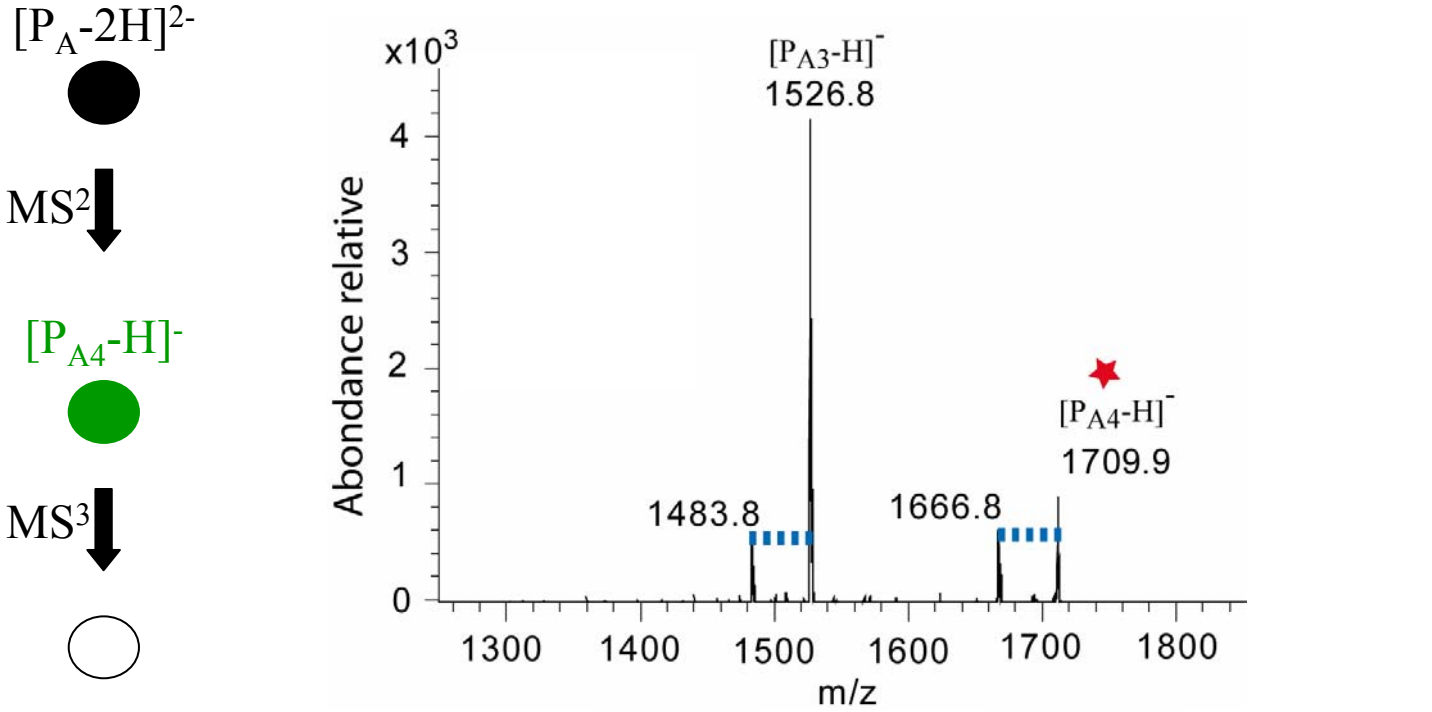


★ precursor ion



3. Results

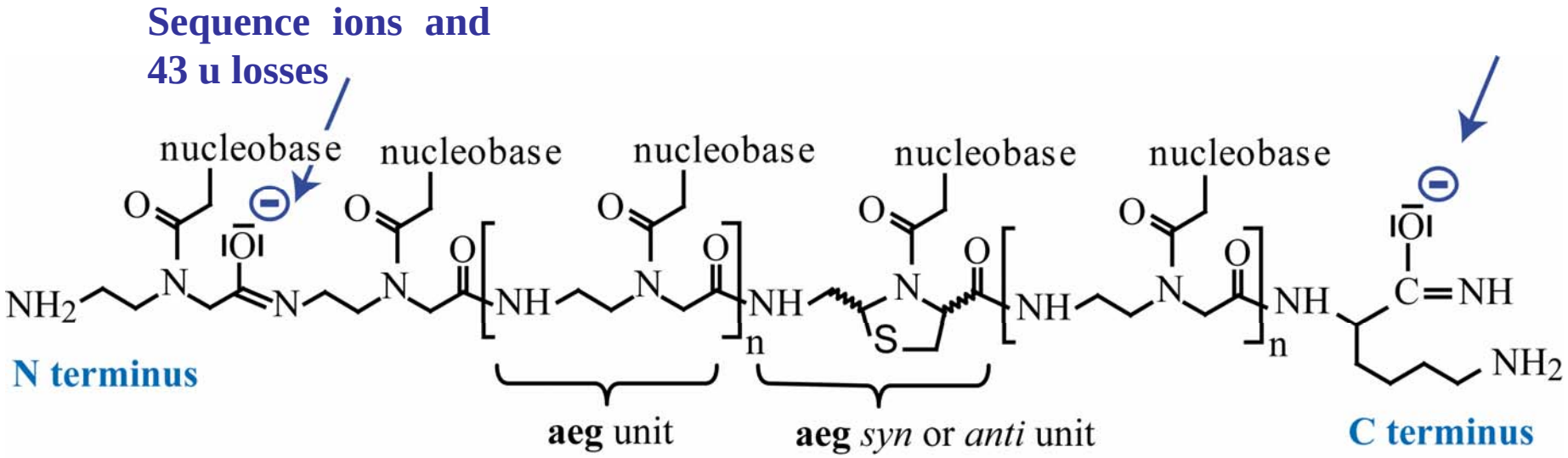
Where are the losses of 43 u ? **See MS^3 !**



precursor ion loss of 43 u

Conclusion

Negative charges location : on the PNA backbone.



4. Conclusions & perspectives

PNA oligomers: - **negative charges** on the PNA **backbone**
- no loss of nucleobase contrary to DNA oligomers.
- a mechanism is proposed for the formation of OCN^-

For a better comprehension of their reactivity:

Determination of PNA thermochemical parameters (acidity and proton affinity)

PNA analysis in positive ion mode

Analysis as a function of PNA sequence

Acknowledgments

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Group of Mass Spectrometry

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