Label-free identification of extracellular vesicles by Raman microspectroscopy

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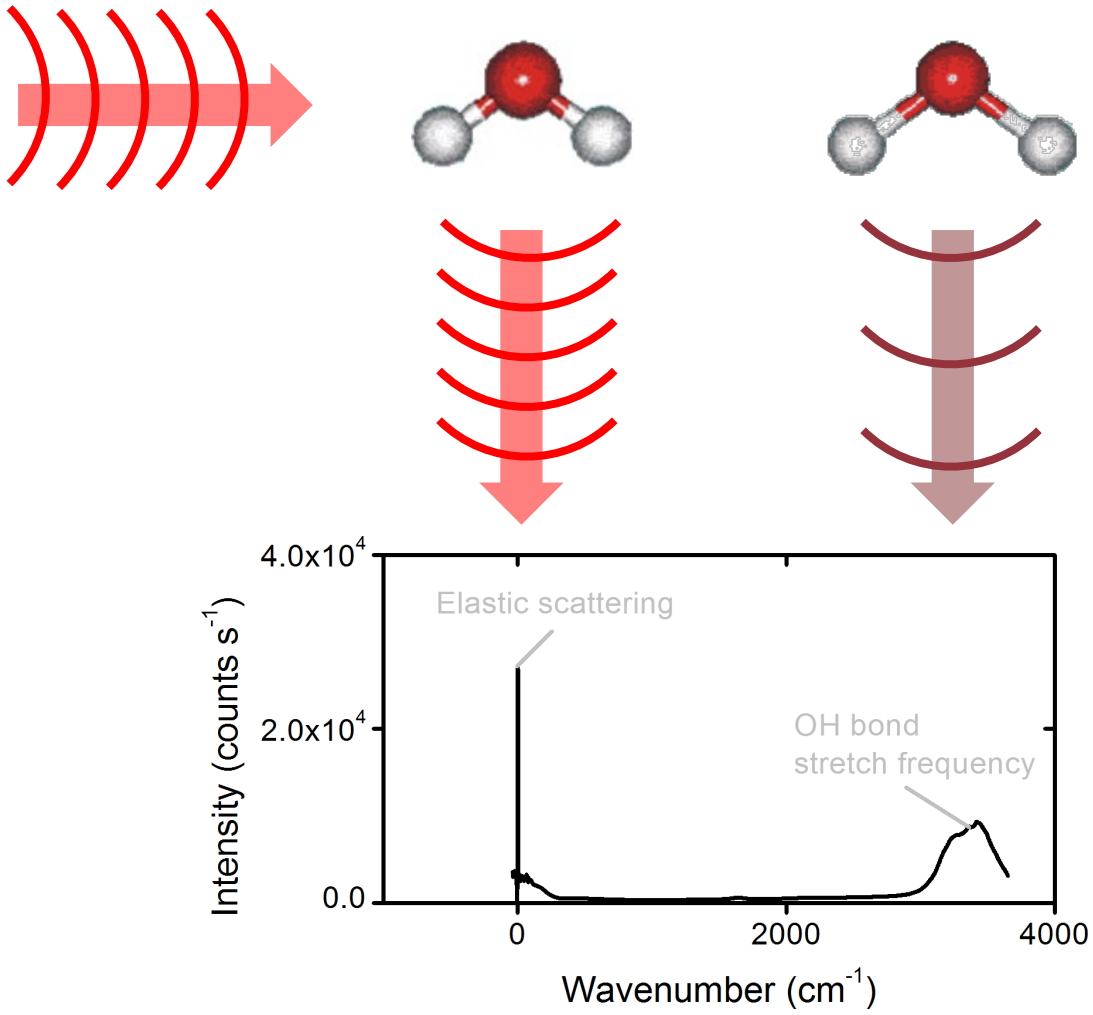
Introduction

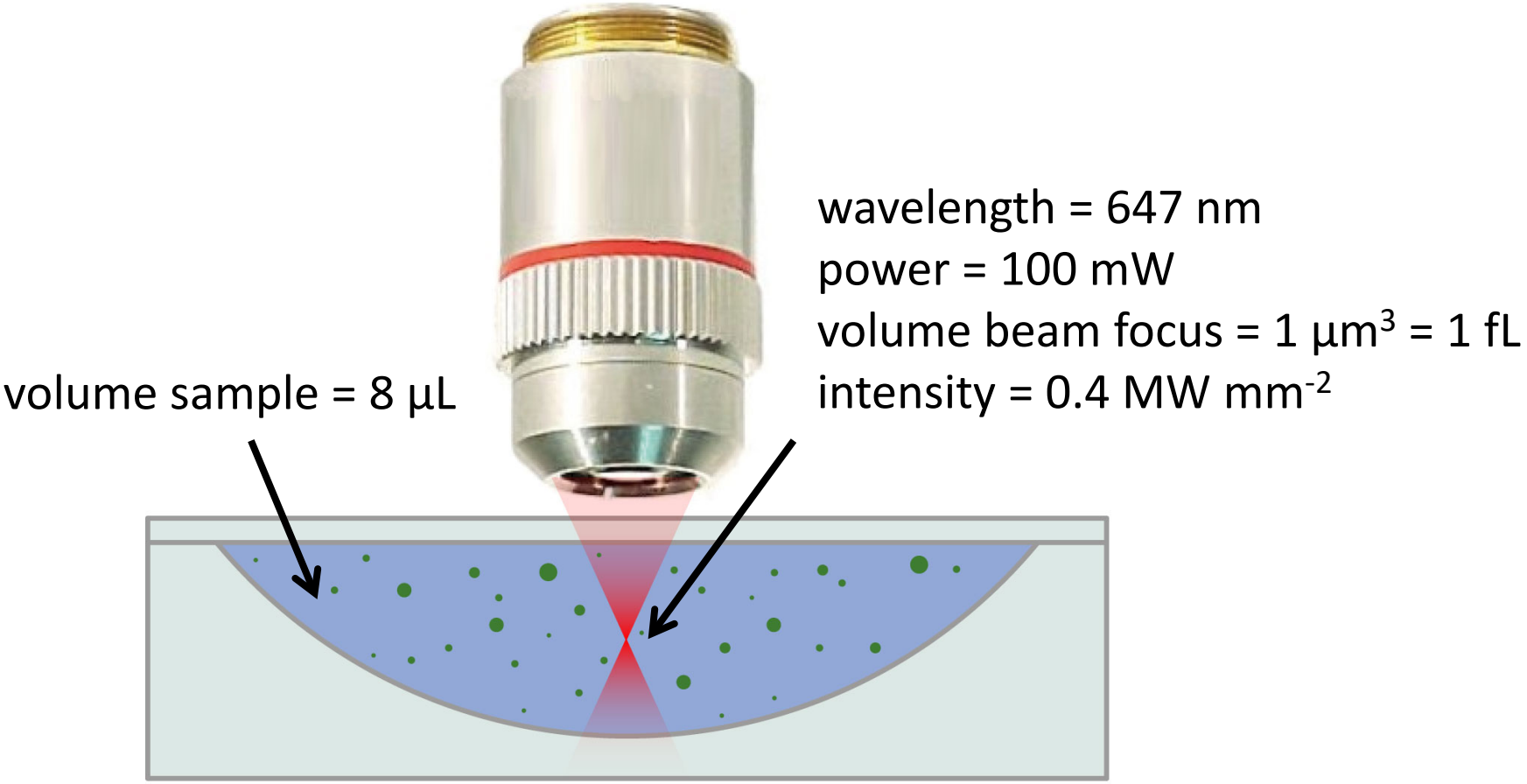
- clinical demand: identification of single (tumor) vesicles in plasma
  - cellular origin
  - type of vesicle
- problem: difficult to detect single vesicles
- goal: distinguish *single* extracellular vesicles of different cellular origin directly in solution *without labeling*
- model:
  - human pancreas adenocarcinoma vesicles (BxPC-3 cell line)
  - platelet vesicles (platelet rich plasma)
  - erythrocyte vesicles (blood bank concentrate)

Light scattering

Raman spectroscopy

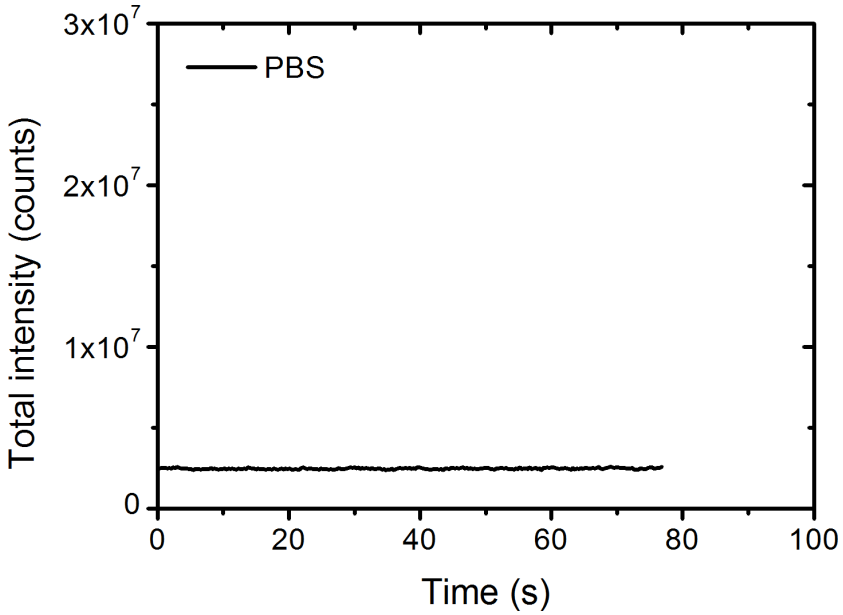


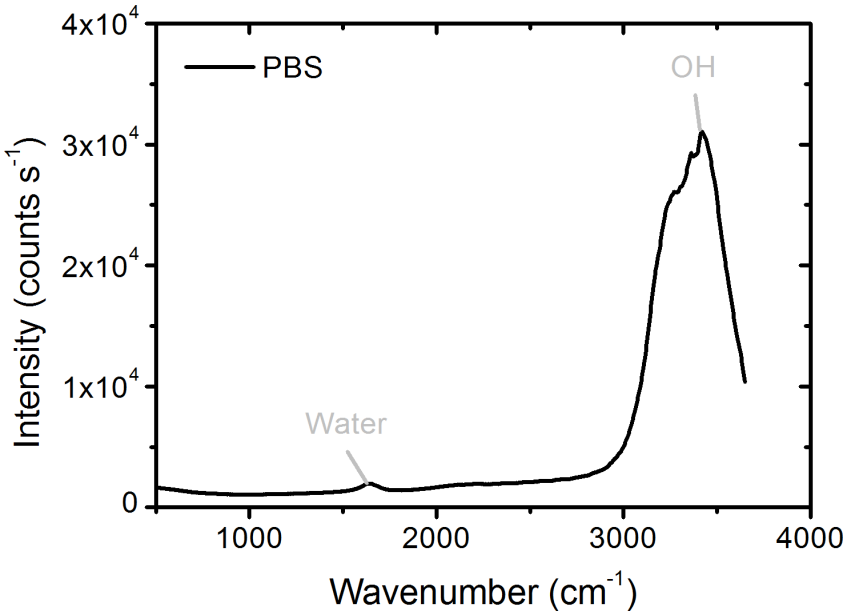
Raman microspectroscopy



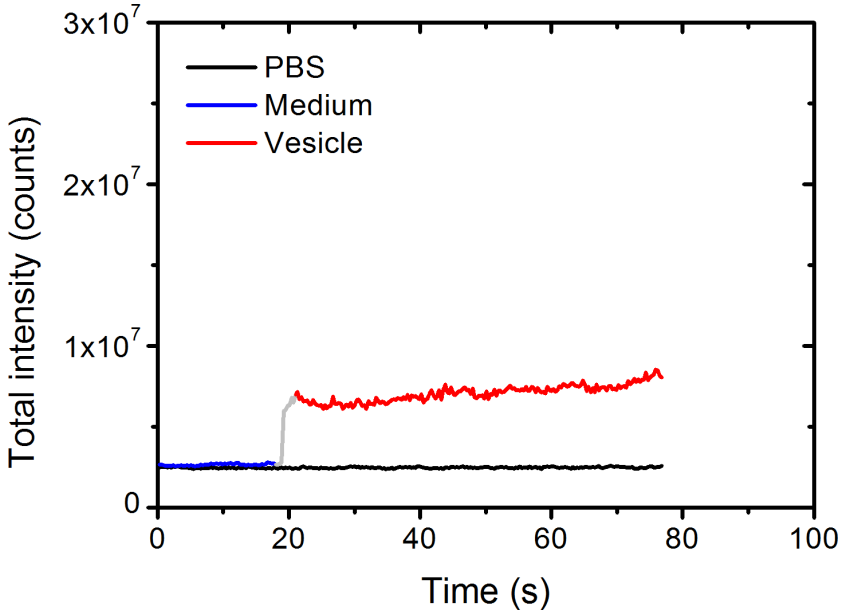
Puppels G.J. et al. Nature 1990; **347**: 301-3
Uzunbajakava et al., Biophys. J. 2003; **84**: 3968-3981

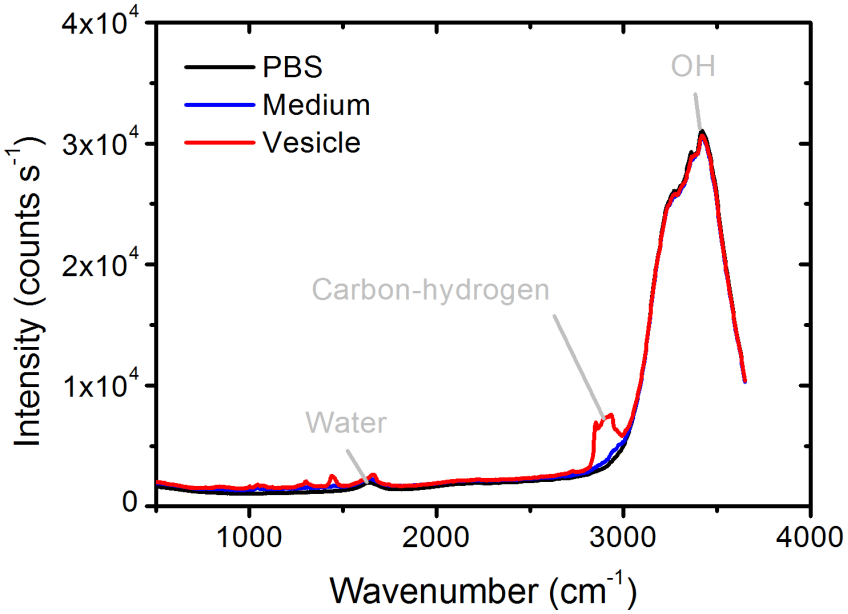
Raman spectrum of PBS



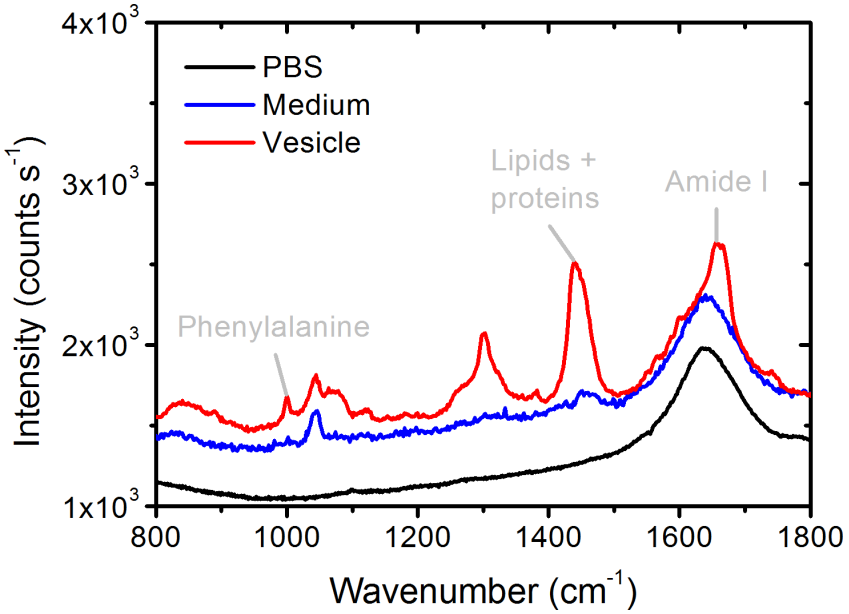


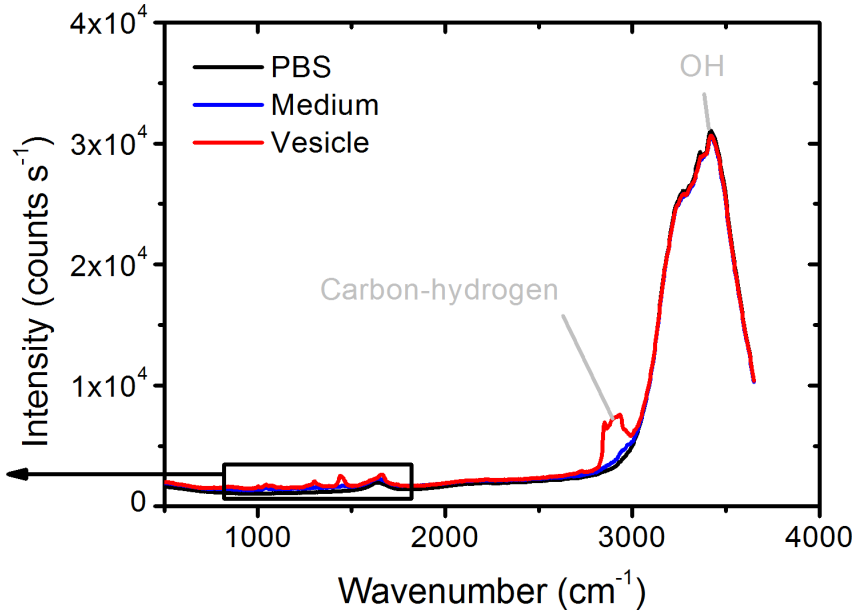
Raman spectrum of single BxPC-3 vesicle



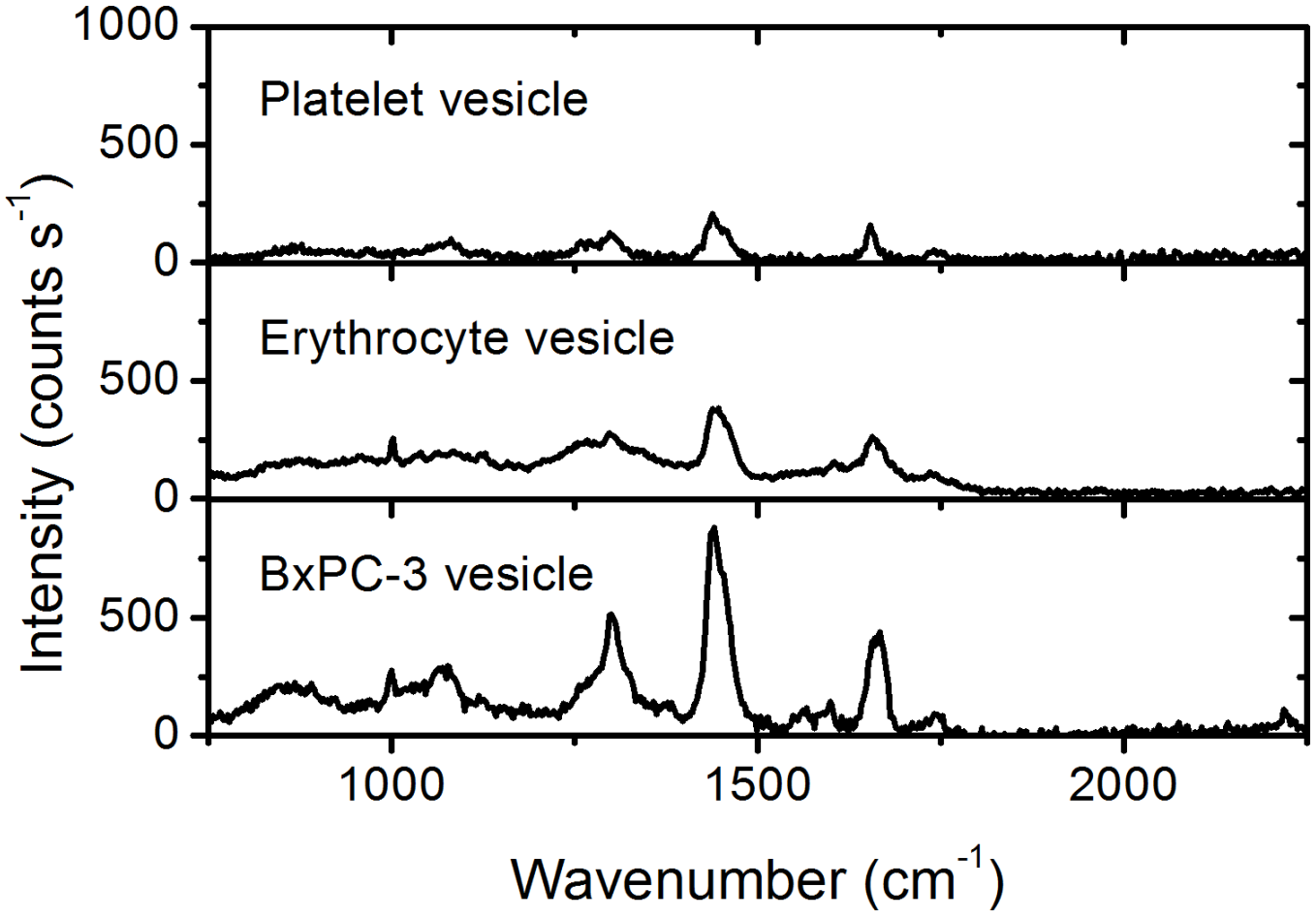


Raman spectrum of single BxPC-3 vesicle





Label-free identification of vesicles



Conclusion

- *single* extracellular vesicles of different cellular origin in solution are distinguished *without labeling*
- biochemical information is obtained from single vesicles without labeling
- need to develop high throughput system

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