Chemistry 416, Dr. Glaser
Applications of Mass Spectroscopy: ESI-MS.

We discussed several ionization methods in class including ELECTROSPRAY IONIZATION, or ESI for short. This is an exquisite method that allows one to get systems with molecular weights of up to 5 million (!!) in the gas phase. The big advantage is that that the ions are multiply charged such that even large masses show up at much smaller m/z values! The following text is "scan-OCR'd" from the text by McLafferty.

> *Electrospray ionization (ESI).* Pioneered by Dole (Dole *et al.* 1971), for ESI a solution of the sample is sprayed at atmospheric pressure through a several kilovolt potential difference toward the differentially pumped entrance to the mass spectrometer (Smith *et al.* 1992). The resulting droplets are electrostatically charged; as the solvent evaporates, electrostatic repulsion produces smaller and smaller droplets, until the macromolecule is expelled "saturated" with charges (Fenn *et al.* 1989). Thus a protein can bear a proton for every 5-17 amino acids, yielding peaks at m/z 600-2000 even for 200 kDa proteins (Feng *et al.* 1991). Similarly, polynucleotides can yield negative ions of such m/z values by losing a proportionate number of protons. This drastically reduced upper limit lor m/z measurement makes ESI amenable to most types of mass spectrometers. ESl mass spectra have been measured for molecules as large as 5 x 10^6 Da (Nohmi and Fenn 1992), and structural information has been obtained from albumin (66 kDa) by tandem mass spectrometry (Loo *et al.* 1991). Using Fourier transform (ICR) mass spectrometry (Section 1.3), ESI spectra of myoglobin (17 kDa) show 900,000 resolving power and < 0.001 Da mass-measuring errors (Beu et *al.* 1993).

I suggest you read the paper by Nohmi & Fenn: Nohmi, T.; Fenn, J. B. *J. Am. Chem. Soc.* **1992**, *114*, 3241-3246. Enjoy!