Our early work to develop a basis for quantitative ultrasound (QUS) imaging started with live animal studies wherein the ultrasonic backscattered coefficient (BSC) was estimated and from the BSC estimate, QUS parameters were estimated. Even earlier (some 5 decades earlier), significant through-transmission quantitative studies of ultrasonic tissue properties were undertaken (absorption and speed). It was our view, based on the significant early echo-based work by Lizzi et al., Zagzebski et al., Insana et al. and Hall et al., that QUS imaging technology had the potential to be a new imaging capability that could be used to augment standard B-mode imaging. QUS imaging utilizes the frequency-dependent information, and thus the backscattered signals are dependent on the tissue properties (size, shape, number, compressibility, density). Estimating QUS parameters requires a model that incorporates a form factor (FF), that is, a mathematical description/model of the backscattered signal of a single scattering structure as a function of frequency; the better the FF describes anatomical scatterers, the more realistic will be the estimates. We initiated our studies by examining in vivo three solid tumor types (fibroadenoma, mammary carcinoma, soft-tissue sarcoma). Initially the Gaussian FF was used. Good agreement between processed ultrasound data and pathologic assessments were obtained, but also important questions were being raised. The questions lead to a new approach to identify more accurate FFs as well as new strategies to extract quantitative parameters from the envelop-detected echo data. The current QUS studies are in collaboration with colleagues at the University of Wisconsin-Madison, Iowa State University, University of Illinois at Chicago, Brown University and Riverside Research. The presentation will provide the basis for QUS based on our early work as well as our on-going work.

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Learning objectives:
1) Understand backscattered coefficient (BSC) QUS parameters and their relations to tissue properties
2) Understand how to acquire QUS parameters from BSCs
3) Understand the basic concept of QUS and BSC analyses
4) Understand QUS parameters and their relations to tissue properties