Atherosclerosis (AS) is the primary pathologic result of obesity. Vulnerable AS plaques cause fatal clinical end points such as myocardial infarction and stroke. To prevent this, improvements in early diagnosis and treatment are essential. Because vulnerable AS plaques are frequently nonstenotic, they are preclinically undetectable using conventional imaging. Levels of blood lipids, C-reactive protein, and interleukin-6 are increased, but are insufficient to indicate the process of critical perpetuation prior to end points. More specific biomarkers (e.g. troponin,

Fig. 1. Plaque and blood biomarkers. CAD = Coronary artery disease.
copetin, natriuretic peptides, growth differentiation factor-15, or soluble ST2) indicate the acute coronary syndrome or cardiac insufficiency, but not critical destabilization of AS lesions in coronary or carotid arteries. Thus, valuable time (months to years) that could be used to treat the patient is wasted. An improved management of this dilemma may involve improved detection of variations in the degree of immune inflammation in plaques using new biomarkers in the blood and/or within the lesion (molecular imaging).

Macrophage and T-cell polarization and innate and adaptive immune responses, e.g. Toll-like receptors (TLR2, TLR4, and TLR7), are involved in this critical process. New biomarkers involved in these mechanisms include pentraxin 3, calprotectins S100A8/S100A9, myeloperoxidase, adiponectin, interleukins, and chemokines. These proteins may also be candidates for molecular imaging using nuclear (magnetic resonance) imaging tools. Nevertheless, the main challenge remains: which asymptomatic individual should be screened? At which time interval? Furthermore, it is essential for biomarkers that they are specific and effective without inducing side effects because the ‘patient’ may yet feel healthy at the time of the successful prediagnosis.

Intense interdisciplinary research in laboratory medicine (biomarkers), nanomedicine (nanoparticle development), and radiology (molecular imaging) will hopefully address these questions.