In this talk, I will propose a gravitational theory in which the effective Lagrangian of the gravitational field is given by an arbitrary function of the Ricci scalar, the trace of the matter energy-momentum tensor, and the contraction of the Ricci tensor with the matter energy-momentum tensor. The matter energy-momentum tensor is generally not conserved, thus leading to the appearance of an extra-force acting on particles in a gravitational field. The extra-force also explicitly depends on the Ricci tensor which entails a significant deviation from the geodesic motion in a strong gravitational field and the possibility of a local spacetime curvature enhancement. The Newtonian limit of the theory is also considered and in the small velocity limit an explicit expression for the extra-acceleration, which depends on the matter density, is obtained for dust particles. The stability conditions of the theory with respect to local perturbations, the Dolgov-Kawasaki instability, are also obtained. The cosmological implications of the theory are investigated and it is shown that for some specific choices of the coupling function the gravitational field equations admit an exponential, de Sitter type solution. Hence a Ricci tensor - energy-momentum tensor coupling may explain the recent acceleration of the Universe, without resorting to the mysterious dark energy.