



Figure 4.7: Horse Pulling a Wagon

According to Newton's third law, whatever the force with which the horse pulls the wagon, the wagon pulls back on the horse with exactly the same force but in the opposite direction. This being so, *why do the horse and wagon travel forward with an acceleration ? Please explain.*



. I have never given this any thought but I see no contradictions. The acceleration would be difficult to explain if the force with which the horse acts on the wagon was counterbalanced by the force with which the wagon acts on the horse. But these forces cannot cancel each other since they are applied to different bodies: one to the horse and the other to the wagon. ■



4.16. Your explanation is applicable to the case when the wagon is not harnessed to the horse. Then the horse pushes away from the wagon, as a result of which the wagon moves in one direction and the horse in the other. The case I proposed is entirely different. The horse is harnessed to the wagon. Thus they are linked together and travel as a single system. The forces of interaction between the horse and wagon that you mentioned are applied to different parts of the same system. In the motion of this system as a whole, these forces can be regarded as mutually counterbalancing forces. Thus, you haven't yet answered my question. ◇



. Well, then I can't understand what the matter is. Maybe the action here is not fully counterbalanced by the reaction ? After all a horse is a living organism. ■



4.17. Now don't let your imagination run away with you. It was sufficient for you to meet with some difficulty and you are ready to sacrifice one of the principal laws of mechanics. To answer my question, there is no need to revise Newton's third law of motion. On the contrary, let us use this law as a basis for our discussion.

According to the third law, the interaction of the horse and the wagon cannot lead to the motion of this system as a whole (or, more precisely,