appeared to be a very crude method when it was first published in 1987 ***(6)***, its potential and effectiveness have become increasingly recognized. For wheat transformation, because there is no versatile biological vector available, and wheat protoplast culture is still an empirical, time-consuming, and genotype-dependent procedure, the microprojectile bombardment of intact tissue, particularly scutellum, became a favorable choice. Third, the *bar* gene, which encodes phosphinothricin acetyltransferase (PAT), was used as the selectable marker, and corresponding substrate, L-phosphinothricin (L-PPT), was used as the selective agent. Although this herbicide selection system does not provide a very "tight" selection, it has been shown to be more effective than some antibiotic selection systems tested. The wheat transformation technique described here is a detailed presentation of these three features, supplemented by the author's relevant research experience over many years.

2. Materials

1. To maintain a steady supply of plant material, wheat plants (*see* **Note 1**) are grown in a greenhouse or growth chamber at regular intervals, in 6 inch diameter plastic pots filled with potting mixture (Ready Earth from W.R. Grace or Fisons M2 or F3 compost). Greenhouse and/or growth chamber conditions are as follows: the first 40 d at 15°/12°C d/night temperature and 10-h photoperiod (300 μm/m^2/s), followed by maintenance at 21°/18°C d/night temperature and 16-h photoperiod (300 μm/m^2/s). Plants are watered every second day and fertilized once a week with 0.4 g/L of soluble greenhouse fertilizer (*see* **Note 2**). Plant spikes are tagged on the first day of anthesis, so that seeds containing immature embryos at correct stage for culture can be collected later.
2. Plasmid DNA, containing a selectable marker (e.g., *bar*), a reporter (e.g., *gus*A), and genes of interest (e.g., a piece of viral genome sequences encoding coat protein [CP] or replicase), is prepared at a concentration of 1.0 μg/μL in sterile dH_2O. Good quality DNA (free from RNA and protein contamination) should be used (*see* **Note 3**). Store DNA solution at –20°C.
3. The Biolistic PDS-1000/He Particle Delivery System (Bio-Rad), or a biolistic device using gunpowder cartridge is needed (*see* **Note 4**). The biolistic device should be situated in laminar flow hood, and the sample chamber of the device should be kept sterile by spraying 70% ethanol before and after use. Rupture disk holder, rupture disks, parts for assembling stopping plate, and sample plate should be sterilized in 70% ethanol and kept under aseptic conditions.
4. Tungsten or gold particles, 1.0 μm in diameter, are usually used (*see* **Note 5**). Particles in 60-mg aliquot are washed in 100% ethanol (HPLC or spectrophotometer grade) in a 1.5-mL microcentrifuge tube, then suspended in 1 mL sterile dH_2O. A 50-μL aliquot (for 4–8 bombardments) of the particle suspension is pipeted into microcentrifuge tubes (1.5 mL), while vortexing the suspension continually. The tungsten particle aliquots should be stored at –20°C to prevent oxidation; gold particle aliquots can be stored at 4°C.