**There is a strong need for the optimized management of the thermal problem in Nd:YAG laser rod and for a powerful, fast, and accurate modelling tool capable of treating the heat source distribution very close to what it actually is. In this paper, a new optimization algorithm**

**called bacterial foraging optimization algorithm (BFOA) is proposed for simulation of the radial heat distribution. A BFOA discloses a simulation method which delivers the exact temperature distribution in a circularly cylindrical structure with a circularly symmetrical, longitudinally, and transversally non-uniform heat source distribution and circularly symmetrical cooling means. The output power is obtained and compared with previously published experimental measurements for different pump power and a good agreement has been found.**