***Abstract--***Biomedical wireless sensor networks (BWSNs) need to guarantee reliable and timely transfer of crucial data in emergency and time critical situations. Current schemes use static/fixed priority assignment mechanism based on source of data and not on the urgency of the data in different situations. This paper presents a novel data transmission scheme, called optimized priority assignment mechanism (OPAM) for BWSNs. The proposed work dynamically schedule different types of data flows based on their time critical nature. It smartly assigns priority to individual data packets rather to particular service or flow by continuously monitoring queuing delay providing guaranteed end-to-end QoS without invoking any congestion control and avoidance mechanism. Experimental results show that OPAM performs better in terms of average throughput and end-to-end delay 55% and 20.5% respectively than Routing Service Framework for standard BWSNs.