Neural control and biomechanics of birdsong: linking song-control circuits to vocal apparatus biomechanics

Abstract

This doctoral project investigates how neural activity is translated into coordinated vocal movements in songbirds, linking brain circuits, the biomechanics of the vocal apparatus, and acoustic output. Using zebra finches, the doctoral project will combine targeted brain manipulations with biplanar X-ray imaging and acoustic analyses to provide a mechanistic, multi-level understanding of birdsong production. The research integrates two complementary fields, neuroethology (Nicolas Giret) and functional biomechanics (Pauline Provini), offering genuinely interdisciplinary training for the student. Expected outcomes include a conceptual framework connecting central control and peripheral mechanics, unprecedented multi-scale datasets, and insights into sensorimotor integration. Results will be disseminated through peer-reviewed publications and presentations at national and international conferences, including the 2027 European Birdsong Meeting. The project adopts a mechanistic, integrative perspective (InLife Axis 2) while leveraging advanced tools inspired by engineering approaches to address fundamental questions in biology.