

A Study of the Life Cycle of an Actinomycete

Introduction

The actinomycetes which represent a **transition** between the bacteria and the **fungi**, compose a large proportion of the soil **flora**. It was not until their capacity to **synthesize** antibiotic substances was recognized that this group of organisms attracted wide-spread attention. However, primarily only those factors which influence antibiotic production **have** been **investigated**. Although sexual mechanisms have been conclusively demonstrated in several fungi and at least one bacterium, the actinomycetes have not been subjected to **definitive** tests.

Background

A generalized life cycle of the genus Streptomyces is as follows: uni- or multinucleate spores germinate by production of one to four hyphae. Growth continues until a mature unicellular mycelium is constituted. Aerial hyphae are then formed which differentiate into spores, beginning at the apical end and proceeding toward the base. **Fragments** of the vegetative mycelium is able to regenerate a mature colony.

Klieneberger-Nobel (1947) reported that the aerial hyphae of Streptomyces result from the fusion of two separate hyphae, producing "zygotic spores". No recombination has, however,

been demonstrated.

Spores often germinate by formation of one to four vegetative hyphae. This phenomena might conceivably be the product of a meiosis..

Proposed Research Project

I. A study of the life cycle of an Actinomycete

1. Isolation of a member of the genus Streptomyces
 - a. one with an optimal temperature of 37° C would probably grow faster than one with an optimal temperature of 28
2. Determination of the minimal nutritional requirements for completion of the life cycle
3. Production of nutritional and morphological marked strains by ultra-violet and X-ray irradiation
 - a. mechanism for screening biochemical mutants
 - 1) use of antibiotics to kill prototrophs followed by addition of supplement
 - 2) stamp technique of Lederberg
4. Recombination tests
 - a. mix reciprocal biochemically marked stocks and plate onto minimal agar
 - b. analysis of the prototrophs
 - 1) heterokaryons yielding only parental types
 - 2) recombinants
 - a) genetic mechanisms
 - b) transformations, test cell-free extracts and by the bundling board.