The Clash of the Modern Crises: A Study Investigating the Development of Antibiotic Resistance in Escherichia coli Under Increasing Carbon Dioxide

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Bacterial mutagenic adaptations contribute to antibiotic resistance, which has emerged as a global threat to public health, threatening the ability to treat bacterial infections and diseases effectively. Antibiotic resistance, as a ‘multifaceted phenomenon’, is affected by many interrelated factors in environmental, agricultural and clinical settings. With global carbon dioxide emissions continuing to increase, studies that have shown increased bacterial mutation in the presence of carbon dioxide may indicate a lesser understood contributor to antibiotic resistance. This study aimed to investigate if increasing concentrations of carbon dioxide affected the development of antibiotic resistance developed by Escherichia coli to tetracycline. Cultures of bacteria were incubated in differing concentrations of carbon dioxide, where resistance was measured using minimum inhibitory concentrations and the Kirby Bauer disk diffusion method. In both constituents of this study, it was found that increased carbon dioxide concentrations resulted in increases in the development of antibiotic resistance acquired by E. coli in the fourth generation. A strong positive correlation was observed between increasing carbon dioxide concentrations and antibiotic resistance ($r=0.85$); and increased antibiotic resistance of carbon dioxide groups in comparison to controls was found to be significant ($p=0.007$), however, significant susceptibility returned to both control and experimental groups ($p=0.0000005$ and $p=0.03$ respectively). This warrants further research to validate potential implications, however, evidence found suggests potential changes to the development of antibiotic resistance as global atmospheric carbon dioxide concentrations continue to increase.

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Third Award of $1,000

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