

## CSE Paper (Martin)

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Hypothermia, the Diving Reflex,  
and Survival

Full title, writer's  
name, name of  
course, instructor's  
name, and date  
(all centered).

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Biology 281  
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(Boston: Bedford/St. Martin's, 2006).

The page header contains an abbreviated form of the title followed by the page number.

Headings, centered, help readers follow the organization.

### ABSTRACT

The abstract indicates the writer's purpose and scope and summarizes the research cited.

This paper reviews the contributions of hypothermia and the mammalian diving reflex (MDR) to human survival of cold-water immersion incidents. It also examines the relationship between the victim's age and MDR and considers the protective role played by hypothermia. Hypothermia is the result of a reduced metabolic rate and lowered oxygen consumption by body tissues. Although hypothermia may produce fatal cardiac arrhythmias such as ventricular fibrillation, it is also associated with bradycardia and peripheral vasoconstriction, both of which enhance oxygen supply to the heart and brain. The MDR also causes bradycardia and reduced peripheral blood flow as well as laryngospasm, which protects victims against rapid inhalation of water. Studies of drowning and near drowning of children and adults suggest that victim survival depends on the presence of both hypothermia and the MDR, as neither alone can provide adequate cerebral protection during long periods of hypoxia. Future research is suggested to improve patient care.

### INTRODUCTION

Drowning and near-drowning incidents are leading causes of mortality and morbidity in both children<sup>1</sup> and adults<sup>2</sup>. Over the past 30 years, there has been considerable interest in cold-water immersion incidents, particularly the reasons why some victims survive under seemingly fatal conditions. Research suggests that both hypothermia and a "mammalian diving reflex" (MDR) may account for survival in many near-drowning episodes<sup>3</sup>. However, the extent to which these two processes interact is not fully under-

Statistics are cited with endnotes.

Research is cited with an endnote.

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stood. There is further controversy regarding the effect of the victim's age on the physiological responses to cold-water immersion. In this paper, I provide an overview of recent research on the protective value of hypothermia and the MDR in cold-water immersions. I also examine hypotheses concerning the effects of age on these processes and conclude with suggestions about future lines of research that may lead to improved patient care.

The thesis states the writer's three main goals and indicates the paper's organization.

#### *Hypoxia during drowning and near-drowning incidents*

The major physiological problem facing drowning victims is hypoxia, or lack of adequate oxygen perfusion to body cells<sup>4</sup>. Hypoxia results in damage to many organs, including the heart, lungs, kidneys, liver, and intestines<sup>5</sup>. Generally, the length of time the body has been deprived of oxygen is closely related to patient prognosis. Only 6-7 s of hypoxia may cause unconsciousness; if hypoxia lasts longer than 5 min at relatively warm temperatures, the result may be death or irreversible brain damage<sup>6</sup>. However, some victims of cold-water immersion have survived after periods of oxygen deprivation lasting up to 2 h<sup>7</sup>. . . .

Subheadings separate distinct parts within a section.

The writer provides an overview of research, cited with endnotes.

[*The student goes on to highlight the major controversies and to add interpretation and analysis.*]

#### CONCLUSIONS

Recent research on cold-water immersion incidents has provided a better understanding of the physiological processes occurring during drowning and near-drowning accidents. Current findings suggest that the cooperative effect of the MDR and hypothermia plays a critical role in patient survival during a cold-

The writer provides a summary and an analysis of research.

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water immersion incident. However, the relationship between the two processes is still unclear. Because it is impossible to provide an exact reproduction of a particular drowning incident within the laboratory, research is hampered by the lack of complete details. Consequently, it is difficult to draw comparisons among published case studies.

More complete and accurate documentation of cold-water immersion incidents--including time of submersion, time of recovery, and a profile of the victim including age, sex, and physical condition--will facilitate easier comparison of individual situations and lead to a more complete knowledge of the processes affecting long-term survival rates for drowning victims. Once we have a clearer understanding of the relationship between hypothermia and the MDR--and of the effect of other factors--physicians and rescue personnel can take steps to improve patient care at the scene and in the hospital.

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The writer provides suggestions for future research.

With permission, the writer acknowledges people who helped with the paper.

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