Physical Responses and Mechanisms

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Age-Related Differences in Neural Taste Responses in Fischer 344 Rats

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Regional Variation in Skin Blood Flow Velocity in Healthy Adults

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A Model of Stress in the Vascular System: Hypertension in the Rat

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Adrenergic Sensitivity in the Mesenteric Artery of the DOCA Hypertensive Rat

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Use of Animal Models in Nursing Science

Age-Related Differences in Neural Taste Responses in Fischer 344 Rats

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Surveys of geriatric units report poor oral intake as one of five major nursing care problems in the elderly population. Diminished taste function has been associated with old age. However, the gustatory mechanisms in aging taste receptors and the biological basis for acuity changes are not known. To determine whether peripheral taste receptor responses differ across age groups, neural signals were recorded from the chorda tympani nerve (CTN) of 6, 24, and 30 months Fischer 344 rats while salts and other chemicals were applied on the anterior tongue.

Magnitude differences were found for NH_4Cl, $MgCl_2$, sucrose, and citric acid ($p < .05$) although the differences were small. No age effects were observed for LiCl, KCl, HCl, or quinine HCl. Male and female rats differed in their responses to NH_4Cl, $MgCl_2$, and HCl ($p < 0.05$) and age by sex interaction effects were significant for NH_4Cl, $MgCl_2$, KCl, and HCl ($p < 0.05$). Although age effects were found for some stimuli, the taste buds on the anterior tongue respond rather well in old age. These results complement recent behavioral studies indicating minimal change in taste sensitivity to NaCl and sucrose. Therefore, it is important for clinicians to consider other possible explanations for diminished taste function in elderly persons such as poor oral environment, undetected pathology, social isolation, or food preparation techniques.

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Regional Variation in Skin Blood Flow Velocity in Healthy Adults

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This study noninvasively measured cutaneous microcirculatory blood flow velocity at six clinically significant sites on the feet, legs, and abdomen. Knowledge of regional and contralateral skin blood flow variation will allow the nurse to monitor the effets of nursing care when skin integrity is altered. The design was descriptive. Subjects were 51 healthy adult volunteers, 44 females and 7 males, mean age 32 (±7 years). Oral and ambient temperatures were repeatedly measured. Laser doppler velocimetry (Medpacific LDV 5000) was used to measure skin blood flow velocity. Skin temperatures and LDV measures were concurrently obtained from the dorsal surface of the feet, the medial aspects of the lower legs, and at two contralateral mid-abdominal sites. Ambient and oral temperatures remained stable among subjects. There were no statistical significances using paired t-tests for contralateral comparison of mean flow velocity and skin temperature differences. Regional differences between feet, legs, and abdomen were significantly different. The findings suggest that blood flow velocity of contralateral sites is similar. Unilateral circulatory disturbances such as surgical and nonsurgical traumas, primary cutaneous lesions, and venous or arterial occulsions are often encountered clinically. When present nursing care measures to improve blood flow can be evaluated on the basis of contralateral flow rates.

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A Model of Stress in the Vascular System: Hypertension in the Rat

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Stress is perceived in a variable manner by individuals and thus the response to stress is necessarily difficult to predict. One criterion frequently used to measure response to stress is that of blood pressure. Hypertension has been identified epidemiologically as a major health problem and as the single most important risk factor for developing a stroke. However the specific mechanism by which this occurs is unknown, and difficult to study in humans.

The specific aim of this study was to systematically test the effects of acute and chronic hypertension on the cerebral blood vessels in rats. Early changes seen in these vessels included: endothelial cell injury, fibrin and platelet deposition, and the later appearance of pits and cord-like strands.

It appears that hypertension of as brief a duration as three months results in injury and restructuring of the lining of cerebral arteries. It seems likely that these early changes described here in combination with other risk factors such as hyperglycemia or lipidemia may act together to predispose the hypertensive patient to further cerebral vascular pathology including stroke. This study serves to underscore the significance of early detection of such high risk patients through blood pressure screening and dietary history and counseling.

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Adrenergic Sensitivity in the Mesenteric Artery of the DOCA Hypertensive Rat

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Functional changes occurring in vascular smooth muscle in hypertension resulting in augmented sensitivity to vasoactive substances remain obscure. The current investigation explored adrenergic sensitivity in the mesenteric artery of the deoxycorticosterone acetate (DOCA) hypertensive rat. Sensitivity to norepinephrine, epinephrine, phenylephrine, clonidine, and methoxamine was augmented in the mesenteric artery of DOCA hypertensive rats. The foregoing was demonstrated by a leftward shift in dose-response curves to alpha adrenergic agonists and a lowering of the ED_{50} in DOCA hypertensive rats when compared to normotensive controls.

The pA_2 for phentolamine in the DOCA hypertensive rat did not differ significantly from the pA_2 value for the normotensive controls, suggesting that augmented sensitivity to alpha adrenergic agonists is not due to a change in receptor affinity in DOCA hypertension. There was no significant difference in sensitivity to calcium in the presence of norepinephrine when DOCA hypertensive rats were compared to normotensive controls, suggesting the absence of alterations in norepinephrine activated channels for calcium.

Contractile responses to norepinephrine, following intracellular and extracellular calcium depletion prior to a period of calcium loading, were augmented in the vasculature of DOCA hypertensive rats, suggesting a possible explanation for augmented vascular sensitivity to norepinephrine.

Use of Animal Models in Nursing Science

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There is generally a paucity of nursing research using animals, perhaps due to few nurse scientists experienced in such research, therefore little awareness of its value, or a condemnation of the idea as inappropriate for the domain of nursing research.

Animal research is mainly done in the basic biomedical field where knowledge is generated to *diagnose, treat* and *cure* disease. Biomedical study of human function in disease progressively has become more microscopic, looking at subcellular systems. This would not be possible without increasingly invasive measurement technology developed through animal research. Nurses may do such research to contribute to health/wellness and disease/illness knowledge, e.g., the pathological mechanisms of hypertension.

However, in nursing the main concern is not with diagnosing and treating disease but rather with diagnosing and treating *human responses* to actual or potential health problems. We do not necessarily focus on health problems that obviously or profoundly jeopardize biological survival and that require invasive therapy. So rather than generating knowledge from a highly particulate, peripheral, somatic view of human function, nursing largely must focus on complex behavioral phenomena of whole individuals, e.g., food/eating behaviors for a clinical understanding of human responses, e.g., anorexia as responses to life changes, aging or a disease/illness like cancer.

As in biomedical basic research, animal research to generate the knowledge of mechanisms involved in complex behavioral phenomena has the potential to be more complete. Greater control over intervening variables and a broader scope of measurement is possible. It can complement human observations. For example, if anorexia is a human response to cancer, we can study internal factors, e.g., hormonal, neurotransmitter, or taste sensation changes as well as external factors, e.g., social milieau, food availability or presentation. Some of these are best measured in animals, some in humans and some in both. Psychosocial as well as physical aspects can be manipulated in animal studies, e.g., grouped living, imposed isolation, light or noise. The lifespan of many species is shorter than humans so the effects of environmental or developmental variables can be more rapidly evaluated.

An obvious necessity is to have animal models that sufficiently mimic human phenomena. This is not always possible so not all or perhaps even most nursing problems lend themselves to animal research. However, the explanatory level of certain phenomena of interest to nursing can be advanced through animal research as a basis for human research.