

WURJHNS Undergraduate Research Forum 2011: Winning Abstracts

Message from the Editors:

In the first year of its induction, the Western Undergraduate Research Journal: Health and Natural Sciences (WURJHNS) set the foundation for undergraduate students at Western to share their research experiences in the form of original research articles, review articles, and Students in the Field reports. We continue to accept submissions from the fields of Biology, Chemistry, Health Sciences, Medical Sciences, and related subject areas. Looking forward, WURJHNS is coming up with innovative ways for the student body at Western to engage in scholarly work. In line with our primary goal to enrich the undergraduate academic experience at Western, this year we held our first WURJHNS Undergraduate Research Forum. This was a great opportunity for students to showcase their research accomplishments in the form of poster or oral presentations (or both) in a conference-style format. Presenters were expected to show a deep understanding of their research, with emphasis on rationale and significance.

We had a good turnout this year, with eight students presenting a poster and eleven students giving an oral presentation. On behalf of WURJHNS, we would like to take this opportunity to thank all the presenters and those in the audience for supporting this event. We would also like to thank our faculty judges for their time, effort and the wonderful support they showed toward undergraduate student research. Finally, we would like to congratulate the following people for their outstanding performance at the Forum:

Winners of the Oral Presentation: Karl Heilbron and Carlee White

Winners of the Poster Presentation: Alex Ng and Yiming Wei

Honourable Mention (Both Categories): Ashley Thomas

All of the winners' abstracts are displayed in this article (with the exception of Karl Heilbron, due to copyright concerns).

WURJHNS hopes to exemplify and strengthen the rich academic tradition at Western. We encourage students to continue their pursuit of academic excellence, to search for *truth* in their scientific endeavours, and to find *usefulness* in the opportunities we present. After all, we take pride in our Western motto.

Alexander Yan and Soniya Sharma
Editors-in-Chief 2010/2011
WURJHNS

Poster Presentation

Presenter: Alex Ng

Unfractionated Heparin vs. Low Molecular Weight Heparin as Prophylaxis Against Venous Thromboembolism post SCI: A Meta-Analysis

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Objective: To examine the effectiveness of unfractionated heparin (UFH) compared to low-molecular-weight heparin (LMWH) in preventing venous thromboembolism (VTE) after spinal cord injury (SCI).

Relevance: Prevalence of VTE has been reported in up to 70-100% of patients with complete motor paralysis after SCI. Hence, prompt and effective pharmacological prophylaxis is critical in improving the outcome of SCI patients.

Methods: Medline, CINAHL and EMBASE databases were searched for relevant articles published from 1980 to November 2010. All trials examining use of UFH compared to LMWH in improving prophylaxis of VTE post SCI were included if $\geq 50\%$ of the study sample comprised of SCI subjects and if the SCI sample size was ≥ 3 . Pooled analysis was performed to establish the odds ratio (OR) and 95% confidence interval (CI) for presence of deep venous thromboembolism (DVT), pulmonary embolism (PE) and adverse events.

Results: The study found PE was higher in participants receiving UFH compared to LMWH (OR: 3.703; 95% CI: 1.217-11.268, $p=0.021$). However, analysis of other outcomes indicated that there were no significant differences between participants receiving UFH and LMWH: DVT (OR: 0.982; 95% CI: 0.520-1.854, $p:0.956$); VTE (OR: 1.518; 95% CI: 0.809-2.850, $p:0.194$); death (OR:1.551; 95% CI: 0.456-5.284, $p:0.482$); minor bleeding (OR: 1.273; 95% CI: 0.791-2.050, $p:0.320$); and major bleeding (OR:2.224; 95% CI: 0.900-5.494, $p:0.083$).

Conclusion: Results of the meta-analysis indicate that LMWH is more effective in preventing pulmonary embolism, but show no significant benefit over UFH in the prevention of VTE, DVT, and other adverse events (death and major/minor bleeding).

Poster Presentation

Presenter: Yiming Wei

Attenuation of Adverse Drug Reactions by Constituents of Traditional Chinese Medicine with Antioxidant and Immunomodulatory Properties

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Hypersensitivity-based Adverse Drug Reactions (ADRs) to the commonly used antibacterial drug sulfamethoxazole (SMX) are a major health problem. Due to the lack of an effective treatment or prevention method with conventional medicine, plant constituents used in Traditional Chinese Medicine (TCM) should be explored as another approach to attenuate or prevent these ADRs. Although the mechanism of sulfamethoxazole hypersensitivity is not completely understood; research points to oxidative stress and protein haptentation caused by the electrophilic hydroxylamine (SMX-HA) and nitroso (SMX-NO) metabolites of SMX as key elements in pathogenesis. We evaluated the ability of ginsenoside Rb1, curcumin and tanshinone IIA to attenuate SMX-HA-induced toxicity and oxidative stress in Jurkat E6.1 immortalized T lymphoblasts cells. Toxicity of all constituents used was evaluated using the MTT assay. The MTT assay was also used to determine cell viability after treatment with SMX-HA in the presence and absence of TCM constituents. These phytochemicals with known antioxidant and immunomodulatory activities did not significantly increase the cell viability of Jurkat cells after SMX-HA hypersensitivity was induced *in vitro*. The lack of cellular response from TCM treatment is likely attributed to toxicity exhibited by all of the above TCM constituents. Previous studies have shown pro-oxidant mechanisms to the constituent's anti-cancer properties, so non-cancerous cells should be used for future studies. Pharmacological studies have also shown poor bioavailability for all of these phytochemicals; thus lower concentrations should be used in farther studies to reduce toxicity and reflect concentrations found *in vivo*.

Oral Presentation

Presenter: Carlee White

Attenuation of Adverse Drug Reactions by Constituents of Traditional Chinese Medicine with Antioxidant and Immunomodulatory Properties

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Phenylalanine biosynthesis depends on six *AROGENATE DEHYDRATASES* (*ADTs*) encoded within the *Arabidopsis thaliana* genome. *ADT1* and *ADT2* encode enzymes with *ADT* and *PREPHENATE DEHYDRATASE* (*PDT*) activity and therefore recognize both arogenate and prephenate as substrates. Unlike these two enzymes, *ADT3*, *ADT4* and *ADT5* are only capable of utilizing arogenate. *ADT6* displays both *ADT* and *PDT* activity in biochemical *in vitro* assays however lacks *PDT* activity *in vivo*. The specific amino acids conferring substrate specificity to *ADTs* and *PDTs* are currently unknown, hence we cannot use sequence comparison to determine if an enzyme can accept arogenate or prephenate. Arogenate and prephenate are structurally very similar and differ only by one amino group. However presence or absence of this amino group causes a charge difference, and we predict that recognition of this charge defines substrate specificity of *ADTs* and *PDTs*. To determine which amino acids need to be changed to convert an *ADT* into a *PDT*, error-prone PCR was used to randomly mutagenize the arogenate-specific *ADT4* sequence. *ADT4* mutant libraries were generated for complementation assays. *pha2* knockout yeast have been transformed with mutagenized *ADT4* cDNA libraries to select for sequence changes that have converted an *ADT* into a *PDT*. As the substrates are very similar we predict that only one or two amino acid changes are sufficient to convert one enzyme into the other.

Honourable Mention (Both Categories)

Presenter: Ashley Thomas

A Novel Anti-Cancer Therapy for Breast Cancer

Ashley Thomas¹

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A common problem with cancer chemotherapies is the lack of specificity towards cancer cells and drug resistance, resulting in diverse and negative side effects. This holds true for current breast cancer treatments. A potential anti-cancer therapy with fewer side effects due to increased specificity for tumour cells is urgently needed. Emerging studies have shown that certain anti-microbial peptides (AMPs) have no effect on normal eukaryotic cells but a destructive effect on cancer cells. In this study, we demonstrate this anti-tumor effect of an AMP called Cecropin B-M, that we isolated from the silk worm infected with *Staphylococcus*. We treated murine breast cancer cell line 4T1 cells with varying concentrations of the peptide for four, eight, and twenty-four hours in an *in vitro* cell culture system. Overall cell death and apoptosis were increased in cells exposed to Cecropin B in comparison with control. In addition, by discovering the upregulation of the apoptotic genes Caspase-3 and Fas in cells exposed to the peptide, we found that Cecropin B mediates its effects via the apoptotic pathway. Using our knowledge of the effect of Cecropin B against mouse breast cancer tumour cells *in vitro*, we examined its effects *in vivo*, using the same cell line to induce tumours in the mammary fat pad of mice. It was shown that Cecropin B prevented tumour growth and eradicated tumour cells. This study demonstrates for the first time the potential of AMP development into anti-cancer therapies. The eventual end goal of this area of study is to develop a novel breast cancer therapy for human patients that, through increased specificity for cancer cells, will reduce negative side effects.