1. THE IMPACT OF WATER QUALITY AND HABITAT AVAILABILITY ON SUBMERGED MACROPHYTES IN THE KROM RIVER (CEDARBERG)

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Submerged macrophytes fulfil important roles within habitats by absorbing nutrients, generating oxygen, stabilising the banks and substrate, modifying physical conditions including flow patterns and providing habitat (hydraulic shelter and food) for fish, invertebrates and periphyton. Due to their sensitivity to both short- and long-term changes in environmental factors, submerged macrophytes can be useful indicators of aquatic ecosystem health. The Krom River in the Cedarberg has been severely modified by invasion of alien fish, dense stands of riparian alien vegetation, river bank clearing, intensive water abstraction and dam construction.

This study aims to evaluate the distribution of submerged macrophytes along the river in relation to physical and chemical characteristics and investigate changes in biomass and cover of submerged macrophytes above and below dam structures. The role of Stuckenia pectinata in altering water characteristics over an 18-hour cycle in relation to biological characteristics was also evaluated.

Preliminary results indicate that there could be a relationship between flow rate and water turbidity and the distribution of submerged macrophyte species in the Krom River. Further, the total biomass of S. pectinata was significantly higher in the river (22.51 ± 3.62) than in the dams (5.42 ± 0.934) during summer (t test 4.566; p<0.05; n=12). Finally, the presence of S. pectinata at the experimental site did not significantly change the summer pH of the water with respect to the control site where S. pectinata was absent (experimental pH 6.88 ± 0.60 and control pH 6.87 ± 0.50).

2. CATOSTYLUS AZANIA SP. NOV. (CNIDARIA, SCYPHOZOA): DESCRIPTION OF A NEW JELLYFISH FROM AROUND SOUTH AFRICA

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The appearance of an unknown rhizostome jellyfish species has been noted periodically in estuaries along the east and south coast of South Africa over the last decade. From material collected between 2013 and July 2016, it is clear that this species differs from others, morphologically, and we describe it as a new species: Catostylus azania sp nov. The new species can be identified morphologically by the number of lappets per octant, shape of velar lappets, absence of radiating furrows stemming from the bell margin and size of the distal end on the oral arm. Molecular analyses of mitochondrial cytochrome c oxidase subunit I (COI)
and nuclear internal transcribed spacer 1 (ITS1) DNA genes support its identity as a new species.

3. CRYPTIC DIVERSITY WITHIN THE SPONGITES YENDOI COMPLEX: A NEW NAME FOR SOUTHERN AND EAST COAST SPECIMENS

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Non-geniculate (encrusting) coralline red algae are widespread in all the world’s oceans where they are often the dominant cover on shallow, hard-bottomed marine environments. The South African rocky intertidal and subtidal habitats in particular are rich in diversity of these algae. The ecologically important, Spongites yendoi is reported to occur around the entire South African coastline and forms a characteristic band on the mid- to low shore, particularly in association with the territorial, gardening limpet Scutellastra cochlear. Molecular-assisted alpha taxonomy, that combines molecular and classic morpho-anatomical data to identify and describe organisms, has revealed a number of cryptic species posing under this name in South Africa. New research is currently proposing a new genus to accommodate South African specimens ascribed to Spongites. The aim of the current study was to provide a new name and description for those specimens found, through molecular analyses, to conform to the ecological concept of South African ‘S. yendoi’ occurring along the southern and east coasts. The new species can be characterised by a suite of morpho-anatomical characters largely associated with the tetrasporangial conceptacle roof anatomy, and by unique psbA sequences. Additionally we provide a key to the South African species currently ascribed to Spongites and the new genus taking cognisance of the field and histological characters useful in delimiting them. This study has highlighted the need to reassess all South African names, for non-geniculate corallines based on type localities of species from other continents and ocean basins, using DNA sequence data.

4. INFLUENCE OF INBREEDING DEPRESSION ON PLANT PERFORMANCE OF MANGROVE POPULATIONS OCCURRING ALONG THE COAST OF SOUTH AFRICA

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Mangroves reach the southernmost biogeographical limit along the African east coast in South Africa where they are distributed in isolated patches along various estuaries from Kosi Bay in Kwa-Zulu Natal to Tyolmnqa Estuary in the Eastern Cape Province. Avicennia marina one of the most common mangrove species in the world, has been documented to have lower genetic diversity and higher inbreeding levels when occurring in range-edge populations. Such studies support the central margin hypothesis which suggests that in general, the genetic diversity is found to be higher in range-optimum populations than in range-edge populations. The low genetic levels and high inbreeding levels observed in A. marina populations occurring along the coast of South Africa has been attributed to various factors such as
population size, coastal geomorphology and estuarine dynamics. Inbreeding in plants may lead to inbreeding depression and increased extinction risk due to the decreased fitness in the offspring. Inbreeding depression may influence various attributes such as seed quality, seed germination, plant growth and survival, flowering and seed production. The objective of this study is to determine how inbreeding depression in *A. marina* populations could affect plant performance and ecosystem functioning by measuring the survival of saplings, changes in population size and structure, growth rates and documenting reproductive success in populations occurring at St lucia, Mnagazana, Wavecrest and Nahoon. So far changes in growth rates and propagule weight have been shown to change from more to less diverse forests but in unexpected ways. It is anticipated that with an increase in inbreeding there will be reduced plant performance and in turn lower ecosystem functioning. Plant performance is important as it may act as indicator of population resilience and such information is important in the conservation of mangrove populations.

5. **BIOMASS ALLOCATION, PHYLOGEOGRAPHY AND PHENOLOGY OF SALICORNIA TEGETARIA ACROSS A GEOGRAPHICAL GRADIENT**

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Phylogeographic patterns of the salt marsh species *Sarcocornia tegetaria* showed possible divergence between the biogeographical regions along the coast of South Africa during screening of nuclear (ITS) and chloroplast (rps16) DNA regions. The objective of this study is to provide more details on the genetic structure of *S. tegetaria* and whether there are differences in biomass allocation and phenology between populations in the two biogeographical zones. The above- and belowground biomass of *S. tegetaria* was harvested, and morphological features, physico-chemical parameters and sediment characteristics measured. The belowground biomass was significantly different between cool temperate estuaries with a mean of 3.11 ± 2.29 kg.m⁻² and warm temperate estuaries with a mean of 4.20 ± 1.83 kg.m⁻². Genetic structure was found using ITS, similar to the warm- and cool temperate biogeographical zones and both ITS and rps16 was different at Orange River mouth, possibly due to the large distance to other estuaries with *S. tegetaria*. The phenology of *S. tegetaria* will be monitored until August 2017 and comparison made between a warm and cool temperate estuary. Intertidal salt marsh habitats are a rare type of plant community found in a narrow portion of the intertidal zone that provide important ecosystem services. The information could be used to infer the historical evolutionary processes that gave rise to the diversity within Sarcocornia species in South Africa and how these species will respond, in future, to the pressures of climate change and development in estuarine habitats.

6. **ASSESSING THE RELATIONSHIP BETWEEN GENETIC DIVERSITY AND DIET SELECTION IN A SEMI-ARID COMMUNAL LIVESTOCK FARMING SYSTEM**

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South Africa is home to many indigenous, locally developed and introduced livestock breeds. Adaptive traits have allowed indigenous sheep and goat breeds to co-evolve in a semi-arid system. These small-stock are characterised by their hardiness and adaption to dry conditions and extensive ranges as well as extreme weather conditions. The introduction of quality breeds has allowed for more diverse genetic material within herds which can maximise meat quality; however the quality and quantity of available forage to livestock is one of the main factors that contribute to low productivity. The aim of this study will be to evaluate feeding selection of different small-stock breeds in the semi-arid to arid Steinkopf communal rangeland in the Northern Cape Province. This study will attempt to (i) assess the diet selection of herded sheep and goat breeds in a semi-arid region (ii) Evaluate the dietary overlap between the different livestock breeds (iii) assess whether genetic variability is linked to a more diverse forage intake of herded sheep and goat breeds in a semi-arid environment. Diet selection, preferences and dietary overlap will be calculated in the wet and dry seasons. DNA analysis of livestock will be assessed for genetic diversity. Results of the DNA analysis will indicate breed variation as well as distinguish between breeds found in the study area. The forage selections identified for each breed will be compared to forage selections of these groups found in controlled studies in a semi-arid system.

7. DIET AND TROPHIC ECOLOGY OF CHUB MACKEREL *SCOMBER JAPONICUS* OFF SOUTH AFRICA: 40 YEARS ON.

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Analyses of stomach contents and nitrogen stable isotopes were utilised to assess the diet and trophic ecology of chub mackerel *Scomber japonicus* off South Africa. Samples were collected by midwater trawling off the south and east coast during a research survey of the Department of Agriculture, Forestry and Fisheries in November 2015. A total of 185 chub mackerel were dissected, from which 47 stomachs were examined for diet composition and 60 dorsal muscle tissue samples processed for Nitrogen Stable Isotopes ratios ($\delta^{15}N$). Stomach content analysis revealed that calanoid copepods were numerically dominant in the diet, but that stomatopod larvae and small fish dominated in terms of dietary carbon. Nitrogen stable isotopes showed a significant increase with fish size suggesting that larger fish fed at a higher trophic level. The trophic level of chub mackerel was lower than previously recorded for fish from the region, possibly due to fish size and/or sample locations.

8. QUANTIFYING FUNCTIONAL GUILDS AND DIVERSITY WITHIN A STRANDVELD ECOSYSTEM: ARE SNAKES UNIQUE?

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Knowledge gaps regarding functional roles of snakes within ecosystems limit our ability to predict the potentially cascading effects their removal might create. Extirpation of snake species could potentially result in losses of ecosystem functionality if those taxa are ecologically unique. We used pitfall and funnel trap arrays, artificial cover object surveys, active searching, passive camera trapping and, pre-existing data to identify terrestrial tetrapod species within the Koeberg Private Nature Reserve. Using literature, we gathered dietary and functional trait information (mass, space use, activity times, and energy flow) for each species. Cluster analyses identified 10 broad dietary guilds and 56 functional guilds using dietary and functional trait data, with four snake species (Pseudaspis cana, Dasypeltis scabra, Homoroselaps lacteus and Lamprophis guttatus) forming unique single species guilds. Using functional diversity (FD) analyses we simulated the effect of removing taxonomic groups (birds, passerines, non-passerines, mammals, reptiles, snakes, and amphibians) and individual species on ecosystem FD. Analysis revealed a dietary FD loss of 6.72% and an all functional trait FD loss of 8.86% after snake removal. This indicated a disproportionate loss of FD considering snakes only made up 4.96% of total studied species resulting in the highest FD loss relative to each group’s contribution to overall species richness. Individual species removal revealed that snakes had the second highest mean per species FD loss for the dietary and all functional trait information with only amphibian species displaying greater loss values. Our findings provide support for the notion that snakes are not functionally redundant.

9. MAPPING KRUGER'S REPTILE DIVERSITY

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Despite the high number of reptile species that are known to occur within the Kruger National Park (KNP), there is a surprising lack of recorded occurrences within the park, which presents various challenges relating to the conservation of these animals. In this study, we assess all available spatial data relating to reptile occurrences within KNP in order to identify spatial patterns of these occurrences and identify areas within the park which are poorly sampled or are data deficient. To compare the spatial arrangements of records within KNP, we divided the park into several grid cells of equal size (1 km x 1 km) and compared the number of recorded reptile occurrences within each grid cell. Within KNP’s 21768 grid cells, we found 7118 geospatially unique records of occurrences for 135 different reptile species. These occurrences were not evenly distributed throughout the park, and a linear regression analysis revealed a positive relationship between the number of records per grid cell and the distance of the cell to the infrastructure network of the park. Additionally, we compared the variation in environmental variables of the areas hosting the infrastructure network to the rest of the park and found that well-sampled areas hosting infrastructure were strongly representative of poorly sampled areas without infrastructure across the park. Thus, although we detect evidence of sampling bias within KNP, areas that are poorly sampled are adequately represented in terms of environmental variation, thereby ensuring the viability of additional analyses such as species distribution modelling in further studies.
10. ASSESSING THE EFFECTS OF SEDIMENT TYPE AND DEPTH ON INFAUNAL BIODIVERSITY AND COMMUNITY COMPOSITION OFF SOUTHERN NAMIBIA

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The BCLME supports one of the largest and most productive commercial fisheries in the world. The benthic regions of these upwelling cells are defined by widespread hypoxic or anoxic conditions which give rise to hydrogen sulphide events. Historically, the ocean depths were considered “species depauperate”. Contemporary research suggests that species richness in the deep sea is comparable to that of tropical rainforests and coral reefs. However, technological and financial constraints make detailed studies of benthic communities challenging. As such, ecological forces driving benthic community structure are still somewhat poorly understood. The benthos is a more complex and dynamic environment than previously hypothesised. The fluctuations in the availability of resources propagate generalist species with pronounced temporal and spatial changes in community composition. Analysis of benthic communities may provide useful data for assessing the condition of marine ecosystems when looking at long-term responses or site-specific impacts. Over 890 samples were collected across nine regions along the inner shelf of the Southern Namibian and South African coastlines from south of the Orange River (29°S) to Luderitz (26°S). Sampled depths ranged from 14m (shallower northern locations) to 141m (southern extent). Sediment texture became finer as bottom depth increased. Sands of terrigenous origin dominated the inner and middle shelves becoming terrigenous muddy sands and sandy muds as sampling moved towards the outer shelf and continental slope. Here we analyse the abundance and environmental data for a specific sediment type to determine whether infaunal biodiversity and species composition remain constant as depth fluctuates.

11. DISTRIBUTION OF THE BENTHIC INVERTEBRATE COMMUNITY AND ICHTHYOFANA ASSOCIATED WITH THE WALTERS SHOAL

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Seamounts are unique topographical features found within ocean basins. These features are considered to be biodiversity hotspots, supporting diverse benthic communities and ichthyofaunal aggregations. Despite their significance, relatively few seamounts have been rigorously studied. Thus, little is known regarding seamounts and their associated ecosystems. Walters Shoal is a shallow seamount, with its peak reaching 18m below sea level, located within the western Indian Ocean. This study aims to describe the benthic invertebrate and ichthyofaunal communities associated with this seamount. In 2014 the R/V Algoa conducted a scientific cruise to explore the benthic invertebrate and ichthyofaunal communities, located between the photic zone to 500m depth, associated with the seamount. The benthic invertebrate community was studied using a remote jump camera system and physical
samples were collected by SCUBA diving and a benthic rough sled. The ichthyofaunal community was studied using stereo and mono baited remote underwater video systems (BRUVs) and physical samples were collected to support identification of species. Preliminary results show that Walters Shoal is dominated by red coralline algae, within a depth range of 20 – 100m, and is characterised by a slow growth profile. This differs from previously studied seamounts which have been shown to be characterised by a high biomass of filter feeders/suspension feeders. Ichthyofaunal community results suggests that the community is comprised of a greater number of widespread tropical species than previously reported.

12. FORAGING ECOLOGY OF THE SNAKES, NAJA NIVEA AND DISPHOLIDUS TYPUS

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Ecological effects of predation by snakes have received increased attention recently but snake foraging ecology remains poorly understood in Africa. The unpredictable feeding and movement patterns, and cryptic behaviour make snakes challenging to find and study. We focused on a well-studied avian system to identify the factors that impact the presence and foraging of snakes in sociable weaver (Philetairus socius) colonies, as well as rates of food consumption by cape cobra (Naja nivea) and boomslang (Dispholidus typus)— the main predators of these colonial birds. We observed 13 weaver colonies during their breeding period from August 2016 to April 2017 and recorded the presence of snakes. Principle component analysis (PCA) was performed to reduce the autocorrelation between spatial variables and temporal variables respectively. Logistic regression analysis showed that both spatial and temporal factors affect the presence of snakes in colonies. However, cape cobras and boomslang appear to be impacted by different factors, with cobras responding strongly to both environmental factors (e.g., minimum temperature) and landscape factors (e.g., colony size), whereas boomslang appear to respond to nest characteristics (e.g., number of active chambers). We identified a significant food type preference for eggs by boomslang, while cobras do not show any preference, consuming both eggs and chicks. Boomslang consume significantly more eggs than cobras, but the opposite is true for the consumption of chicks. Our studies help improve our understanding of the impacts of snake predation on these ecosystem engineers and therefore the indirect impacts of snakes in the ecosystem.

13. ASSESSING THE COMPOSITION AND STRUCTURE OF NEUSTON COMMUNITIES IN THE SOUTHERN INDIAN OCEAN GYRE

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Neuston occupies the sea-air interface of a water column in freshwater and marine environments. As consequence of neuston drifting on the surface of the ocean, they experience a range of environmental stresses. The aim of this study was to investigate the neuston community within the southern Indian Ocean gyre. The objectives were to investigate the neuston community’s diversity and abundance in the gyre, compare the samples from the
station, to observe how similar or dissimilar they are, and to graphically represent the relationships between the stations and its samples. Samples were collected from the centre of the gyre using a manta trawl net, where a total of three samples were collected per station. PRIMER –E software was used for the statistical analysis. A number of tests were performed these included diversity indices, multidimensional scaling plot, distance based linear model, ANOSIM and SIMPER analysis. The results showed that the neuston community within the gyre is similar in composition and structure to communities in other parts of the ocean. It was also evident from the CTD results, that depth (sound) and integrated fluorescence had contributed 79% to the variability within the community. Although a full comprehensive analysis was not done on all samples collected due to the time constraints, the study assists

14. QUANTITATIVE DESCRIPTION OF THE CNIDOME OF CATOSTYLUS (SCYPHOZOA, DISCOMEDUSAE) FROM SEVERAL ESTUARIES AROUND SOUTH AFRICA

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A new scyphozoan species Catostylus azania sp. nov. has been discovered in several estuaries around South Africa. Although there are no clear differences in the morphology of the medusa between locations, there are differences in the genetic make-up of populations. The cnidome is known to be used to distinguish between different species of cnidarians, but its use at a population level is still unexplored. This study was aimed at describing the cnidome of C. azania sp. nov. collected from four different estuaries around the coast of South Africa, and to determine if it could be used to distinguish between different populations. Catostylus azania sp. nov has five distinct types of nematocysts; Type 1 and 2 oval-shaped holotrichous isorhizae, Type 1 and 2 rhopaloids, and P – mastigophores. Breede River specimens lacked Type 1 oval-shaped holotrichous isorhizae and Type 1 rhopaloids, while possessing P – mastigophores. Undischarged nematocysts showed no difference in sizes between tissue types, except for Type 1 oval-shaped holotrichous isorhizae. Most nematocysts also differed in size between locations. Discharged nematocysts showed no difference in size between tissues, except for Type 2 rhopaloids. There was a large variation in the relative abundance of nematocysts between locations for each type of tissue, although populations from Krom River and Mgwalana River were most similar. Differences in the cnidome compliment between populations could be linked with the difference in genetic structure, and could be used to distinguish between different populations of scyphozoans.

15. ASSESSING THE RELATIONSHIP BETWEEN LANDSCAPE FUNCTIONALITY AND SMALL MAMMAL ASSEMBLAGES IN THE ARID COMMUNAL DRYLANDS OF STEINKOPF, NORTHERN CAPE

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Rangeland ecology is a broad subject but most published research in the field focuses on animal production. Thus, few studies have explored rangeland ecology from a landscape functionality perspective. Rangeland functionality in relation to pastoralism is important to allow for optimum fodder production, sustainable use of resources and subsequently improved livelihoods. The arid and semi-arid ecosystems in Steinkopf are not managed differently even though they have different rainfall regimes and hence the question arises: how does it affect landscape functionality? Functionality also impacts on small mammals, which are very important since they assist in various system functions, their feeding, excretory and fossorial habits allow for enhancement of nutrient cycling, water infiltration and soil stability. Their populations can decline due to a reduction in functionality and habitats for them to survive. To fill this knowledge gap, the following research approach will be explored in the communal area of Steinkopf. Nine sites will be selected to perform a Landscape Functional Analysis, Point Centred Quadrat and Soil Surface Assessment using Tongway & Hindley (2005). Three sites will be selected in each area (Desert biome, the ecotone, Succulent Karoo biome) in a linear sequence. Three replicates of each site will be done resulting in 27 sites being selected for statistical reliability. The small mammals will be trapped using Sherman live traps in one site of each area that will be a representative of each area. The data will be analyzed using appropriate statistical tests. To compare the small mammal assemblages and body condition with landscape functionality data a MANOVA will be used. This study will assist in improving management strategies of communal rangelands to ensure its health and functionality, and the conservation of the small mammal assemblages in arid areas.

16. THE CAPE WHIP SNAKE: A RESOLUTION OF THE PSAMMOPHIS LEIGHTONI COMPLEX

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Subspecies of the Psammophis leightoni complex (P. leightoni leightoni, P.l. namibensis, and P.l. trinasalis) were elevated to species status (2002) on the basis of poorly-defined ecological differences and allopatric geographic distribution ranges. A 2008 phylogeny of the Psammophiidae did not support the specific status of P. leightoni and P. namibensis, although inadequate sampling (one sample per putative species) limited phylogenetic inference. Psammophis leightoni, a Western Cape endemic, is currently listed as Vulnerable by the IUCN and is considered threatened, largely due to habitat loss. However, the current taxonomic uncertainty surrounding the complex poses a significant challenge to the conservation of P. leightoni which would not be considered threatened if P. leightoni and P. namibensis represent a single taxon. We aimed to validate the taxonomic status of the Psammophis leightoni complex using a phylogenetic framework and Species Distribution Modelling (SDM) techniques. Our Maxent models provided good fits of the data, producing high area under the curve (AUC) statistics of the receiver operating characteristic (ROC) plots (AUC: 0.89-0.99), supplemented with high true skill statistics (TSS: 0.84-0.99). Using conservative model thresholds, we show species connectivity, suggesting that currently, genetic exchange between these two taxa is likely. Additionally, by estimating sequence divergence between taxa within the ‘leightoni’ complex, divergence is indeed representative
of intraspecific variation (0.18 - 6.3 %). This falls below the intraspecific cut-off for this genus (9 %). As a result, we do not support the current taxonomic status of species within the ‘leightoni’ complex, and we recommend it be revised as a single species.

17. ASSESSING HAEMOPARASITISM AND SUBSEQUENT DISEASES OF HERDED SMALL Ruminants in ARID COMMUNAL Rangelands of SOUTH AFRICA

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Parasites could possibly be the largest threat to livestock production. They lower overall productivity and the health of herds and in doing so reduces the potential economic benefit to farmers and rural communities. There are a number of factors that lead to disease susceptibility and heightened response, this would include but are not limited to poor hygiene, the lack of preventive medicines, malnutrition, and increased stress. There are also external factors, which play a role in the flourishing of disease such as climate. However, it all comes down to bad or lack of proper livestock management. Susceptibility to parasites is increased by the weakening the animals’ immune system because of poor veld condition when animals do not get sufficient quality food to eat. The lack of proper nutrition with added stressors from an extensive management system allows for the success of parasites with sheep and goats. Thus the aims of this project are to investigate the parasitic loads of small ruminants in an arid communal rangeland which utilises an extensive management system and, to determine and assess the pathogens these parasites harbour and lastly to make viable recommendations in terms of management and treatment of parasitic control. Research aims include determining the density and diversity of (1) tick loads of small ruminants (2) internal parasites (helminths and coccoidia). Lastly, (3) to identify any pathogens present using PCR (polymerase chain reaction) analysis from tick samples for the presence of diseases. To fulfil these aims, sampling will occur within the Steinkopf communal rangelands in the Northern Cape Province of South Africa. Results of this study could provide insight into the future management and treatment of parasites.

18. MORPHOLOGICAL, ACOUSTIC AND GENETIC DIVERGENCE IN THE BLADDER GRASSHOPPER BULLACRIS UNICOLOR

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Although the processes that promote biodiversity remain poorly understood, geographic variation resulting from selection and/or neutral processes is thought to be a precursor to allopatric speciation. An examination of intraspecific divergence in multiple traits and their co-variation is an essential part of understanding the origin of new species. Here we investigate patterns of geographic variation in acoustic, morphological, and genetic characters of allopatric populations of the bladder grasshopper Bullacris unicolor. We found significant
geographic variation in both temporal and frequency components of male advertisement calls, as well as in morphological variables of males and females. However, acoustic characters were much more strongly differentiated between populations than were morphological characters, with no correlation between acoustic and morphological traits. Furthermore, analysis of the mitochondrial DNA marker cytochrome c oxidase I indicated strong genetic structuring, pointing towards genetic isolation among populations in the absence of isolation by distance. Furthermore, we found genetic distance was significantly correlated with morphological differentiation, but not with acoustic differentiation. The high levels of variation in male advertisement calls between populations, as well as the lack of association between acoustic and genetic distance, suggests that divergence in acoustic traits cannot be attributed to genetic features, and is more likely due to alternative selective pressures, such as mate choice or the ecological environment. Our results further suggest that morphological and acoustic features are uncorrelated at the intraspecific level and appear to be evolving under separate selective pressures.

19. HYBRIDIZATION OR SPECIATION? UNDERSTANDING CRYPTIC DIVERSITY IN A REPORTEDLY WIDESPREAD SPECIES OF NON-GENICULATE CORALLINE RED ALGAE

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Coralline algae are widespread in all of the world’s oceans. Despite their ubiquity, they are a comparatively poorly known group of algae. Ongoing taxonomic changes have meant that the classification and characterisation of these algae are in constant flux. Recent molecular-assisted alpha taxonomy has demonstrated that coralline algae are generally not widely distributed and that we have highly underestimated their diversity, largely due to high levels of cryptism. For South Africa, the reported widely distributed Spongites yendoi has been demonstrated to be no fewer than six different cryptic species. Along the South African west coast, three morpho-anatomically indistinguishable species (here referred to as Spongites sp.6, 7 and 8) have been established to occur, all of whom have distinct geographic distributions. Based on pbsA sequences, Spongites sp. 6 and Spongites sp. 8 share seven unique single nucleotide polymorphisms (SNPs). Spongites sp. 7 and Spongites sp. 8 share six unique SNPs at different base pairs (bp). Spongites sp. 8 has five unique bp that it shares with neither Spongites sp. 6 nor with Spongites sp. 7. Spongites sp. 7 has four other bp that are variable. The initial interpretation of these results were that Spongites sp. 6 and Spongites sp. 7 are different species, but in some places are hybridizing, resulting in Spongites sp. 8. However, sea surface circulation patterns are suggesting two separate speciation events, and that separately Spongites sp. 8 has given rise to both Spongites sp. 6 and Spongites sp. 7. We are currently interrogating these suggested opposing events.
20. SEXUAL SELECTION AND SPECIES RECOGNITION IN MALAWIAN CICHLID FISHES

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In Lake Malawi, there are as many as 1000 endemic cichlid species arising from a single common ancestor. These fishes are thought to have evolved ~ 700,000 years ago. Previously, it was thought that sexual selection by female choice acting on male colour was the main factor contributing to the diversity of African cichlids. Male coloration differs strikingly among closely related species while female colour is often phenotypically similar. However, cues such as visual, acoustic and chemical are also thought to be important in mate recognition. In this study, mate recognition was tested between two closely related species, *Metriaclima callainos* and *M. estherae*. Female preference was measured by giving females a choice between males of different species. Female preference was tested by employing visual cues only, a combination of visual and chemical cues and chemical cues only. The amount of time the females spent with each male was recorded. Results indicate that there was a significant difference in the amount of time females *M. callainos* spent with their conspecific males (p<0.05) in all three tests. There was no significant difference in the amount of time *M. estherae* spent between the different males (p>0.05) in all three tests.

21. EVALUATING THE ROLE OF ACTINOBACTERIA IN PLANT HEALTH AND GROWTH ENHANCEMENT OF ASPALATHUS LINEARIS

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Due to rapid climate change there is an urgent need for more sustainable and environmentally friendly approaches to remediate the increasingly low yields of commodity crops. This has led to increasing interest in plant growth promoting bacteria (PGPB), as opposed to chemical fertilizers/pesticides. Rooibos (Aspalathus linearis) is an internationally renowned tea and a valuable commodity crop with known beneficial health properties. Rooibos is indigenous to the Cederberg region, where it is exposed to harsh environmental factors which could provide a unique niche for bacteria to colonize.

The rhizosphere is an abundant source of plant growth promoting bacteria (PGPB). Actinobacteria are ubiquitous in nature and are one of the most abundant microbial populations found in soil and plant tissue. They have the ability to produce valuable primary and secondary metabolites, ranging from enzymes, antimicrobials and plant growth promoting compounds. Hence, the aim of this study is to isolate, evaluate and identify plant growth promoting actinobacteria and to screen isolates for the ability to enhance plant growth. A large number of actinobacteria have been isolated (140) from Rooibos plant’s roots and leaves, as well as the associated soils. The isolates were screened for direct and indirect plant growth promoting properties. Preliminary results show that a large portion of the actinobacterial isolates may potentially stimulate the growth of the host plant.
22. THE PRESERVATION OF DNA FROM SALIVA SAMPLES IN SUBOPTIMAL CONDITIONS

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Population genetics requires a range of DNA samples from several population groups. This means that samples may need to be collected from donors inhabiting remote and isolated locations. These remote locations may not have optimal storage facilities to preserve the collected biological material. In these cases saliva has been established as a good alternative source for genomic DNA as it can be stored at room temperature.

In this project an economical saliva collection method was optimised to compete with existing saliva collection kits with similar preservation results. Commercial kits such as Oragene® DISCOVER (OGR-500) and Norgen Saliva DNA collection and preservation device are able to preserve saliva samples up to 5 years. Once collected, the saliva was stored in a dark environment without refrigeration.

The extracted DNA was quantified using a qPCR method and genotyped using AmpFlSTR® Identifiler® Plus. The DNA concentrations obtained from 250µl saliva + 250µl buffer ranged between 10 and 40ng/µl. The integrity and quantity of the samples were obtained for all time periods up to two years. Additionally; full profiles were obtained for all tested samples for all time periods up to two years. In conclusion, the novel storage buffer was shown to preserve the genomic DNA over this period. Full profiles were obtained after the two year period at room temperature in a dark environment.

23. A NEURO-ENDOPHENOTYPIC APPROACH TO UNDERSTANDING THE GENETICS UNDERLYING EXTREME VIOLENT BEHAVIOUR IN SOUTH AFRICA

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Understanding the genetic basis of extreme violent behaviour is an important component to addressing this social concern. However, drawing a direct causal link between genes and such a complex socio-cultural phenotype is complicated by factors such as substance abuse, epistasis, and epigenetic effects from one’s familial and cultural environment. The focus of this study will be on an intermediate phenotype (or endophenotype) at the neuro-cognitive level. We will conduct brain activity pattern and neuro-psychological analysis to correlate differences in an attention-based mental trait with the variation in genes (e.g. Monoamine Oxidase) found to be present in persons convicted of extremely violent crimes. Although the conclusions drawn from one such study is insufficient to identify a definitive approach to dealing with this public issue, in combination with other studies over the long term may generate viable solutions someday. The purpose of this study is to contribute to the growing body of knowledge that is accumulating from studies such as these being carried out around the world because conclusions drawn from them are not necessarily valid to apply in South Africa given the genetic diversity here.
24. MAGNETOTACTIC BACTERIA DIVERSITY IN MARINE AND FRESHWATER ENVIRONMENTS OF SOUTHERN AFRICA

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The ability of magnetotactic bacteria (MTB) to biomineralise iron-containing magnetic magnetite and/or greigite nanoparticles positions them as important ecological components, as well as potential targets for biotechnological developments. In the current study, culture-dependent and culture-independent techniques were used to reveal the diversity of MTB communities found in selected regions of Southern Africa. Phylotypes closely related to previously described MTB including Southern and Northern Hemisphere strains such as Magnetococcus marinus MC-1, Magnetofaba australis, Magnetospira thiophila MMS-1, were found. Sequence analysis also reveals that magnetosome gene islands (MAI) in these communities, which are responsible for iron biomineralisation, are similar to those of known phylotypes. However, some sequence variability in 16S rRNA genes and magnetosome genes suggests the presence of novel phylotypes within these environments.

25. DEVELOPMENT OF A MODERATELY HALOPHILIC BACTERIAL EXPRESSION HOST FOR APPLICATION IN MINE WASTEWATER REJECT BRINE MANAGEMENT.

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Reject brine is a concentrated hypersaline by-product of desalination that can not be recycled and must be disposed of. The eMalahleni water reclamation plant uses an evaporation pond system for reject brine disposal. The evaporation process results in the precipitation of salt crystals that may be land filled in situ or collected and disposed of elsewhere. The efficiency of this method depends on ensuring high evaporation rates from these ponds, to prevent more brine entering the ponds than can be removed through evaporation. Halophilic bacteria that grow and produce carotenoid pigments in saltern evaporation ponds may be a viable alternative to adding synthetic dyes to evaporation ponds to increase current evaporation rates. In this study, inoculation of brine with a culture of a moderately halophilic Planococcus maritimus isolate (Cp5-4), that produces an orange pigment (495 nm absorbance), resulted in a 20-30% increase in evaporation rate compared to the control. To determine if darker pigments will further increase the evaporation rate the heterologous expression of the violacein pathway, a 7.5 Kb five gene operon from Janthinobacterium species HH01 that produces a purple pigment (585 nm absorbance), is being developed. The development of the engineered strain will be described.
26. DEVELOPMENTAL VALIDATION OF THE UNIQ-TYPER™ Y-STR KIT FOR FORENSIC APPLICATIONS.

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In forensic casework, Y-chromosome short tandem repeats (Y-STRs) are essential for differentiating between unrelated males and resolving the male component of female: male and male: male admixed biological evidence. The UniQ-Typer™ multiplex combines the ten Y-STR loci (DYS710, DYS518, DYS385ab, DYS644, DYS612, DYS626, DYS504, DYS481, DYS447 and DYS449) of which four are classified as rapidly mutating. In our previous research these markers significantly improved discrimination amongst native male population groups in South Africa compared to the core Y-STRs of commercial kits. In this study the UniQ-Typer™ host to a novel multiplex chemistry is being validated for forensic applications and its potential for cost effective reference genotyping using a fast direct amplification approach. A rapid two-step PCR thermal cycling protocol of ~45 minutes achieved by adopting a higher annealing temperature provided full DNA haplotypes using low copy number template. In mixture studies full male haplotype resolution was obtained for male: male and female: male mixture samples. The multiplex chemistry was validated using common PCR inhibitors of blood and soil, extracts of blood stained jeans, leather, crude biological evidence, degraded DNA samples and various direct amplification substrates. We herein present the applicability of the UniQ-Typer™ for sexual assault casework analysis which may provide rapid turnover times in generating reference haplotypes and substantial discrimination in populations of low Y-chromosome diversity.

27. BIOACTIVE ACTINOBACTERIA ASSOCIATED WITH TWO SOUTH AFRICAN MEDICINAL PLANTS

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Actinobacteria are a source of biologically active compounds that are important for the pharmaceutical, biotechnology, and agricultural industries. These organisms produce a vast range of biochemicals including antifungals, anti-bacterials, anti-tumour compounds, and anti-inflammatory compounds. The search for new, unique, and naturally produced biochemicals have identified unique environments as a niche source for the discovery of novel bioactive compounds. The Cape Floristic region in South Africa is a biodiversity hotspot due to its unique environment and hosts a range of medicinal plants. This study focuses on the actinobacteria associated with two commercially important medicinal plants known to produce many medicinal compounds, Aloe ferox and Sutherlandia frutescens. This study aims to discover novel actinobacteria species and new bioactive compounds that can be used in the pharmaceutical, biotechnology, and agricultural industries. Many actinobacteria (430) associated with these two medicinal plants were isolated. Preliminary results show that actinobacteria isolates have high antibacterial activity against pathogenic bacteria, including E. coli (17), S. aureus (35), M. aurum (19), and E. faecalis (22). Future work will include further screening of isolates for anti-tumor, anti-inflammatory, anti-diabetic, and antioxidant activity, after which the bioactive compounds will be purified and characterize.
This study focuses on development of green procedure for the preparation of silver nanoparticles (AgNPs); which can be utilized in biotechnology and environmental cleaning applications. This is highly desirable because of the rising environmental apprehensions caused by excessive use of chemical solvents. The Ag nanoparticles were synthesised by exposing the silver nitrate ions to the extract of two indigenous teas to South Africa (Rooibos and Honeybush) in aqueous solution under stirring conditions for 20 min. Silver nanoparticles with size ranging between 9-26 nm using Rooibos (Rb) and 60-80 nm using Honeybush (Hb) were synthesized. The formation of AgNPs was confirmed using UV–vis spectroscopy, with a surface plasmon resonance band located at 407 nm for Rb indicating small and monodispersal AgNPs, and at 420 nm for Hb indicating larger and aggregated AgNPs.

FRAP assay test of the teas in different extraction solvents showed that Rb had greater reducing and stabilizing power than Hb. The antibacterial property of Ag nanoparticles was also evaluated against B. cereus gram positive bacteria, using a well diffusion assay to determine minimum inhibitory concentration. The microbes have shown same sensitivity to AgNPs and silver nitrate, and at this stage it cannot be concluded that AgNPs are responsible of the observed antimicrobial effect as they still need to be further purified to remove the silver nitrate and by products and retested.

The increasing antibiotic resistance by pathogens and lack of therapeutic compounds for Human Immunodeficiency Virus (HIV) and other diseases, has prompted the search for novel bioactive compounds. Research has shown that the marine environment is a good source of highly potent, novel and chemodiverse natural product structures compared to the terrestrial environment due to complex living conditions and species diversity. Non-ribosomal peptides (NRPs) are a group of natural products biosynthesised with multimodular non-ribosomal peptide synthases. This class of natural product is of particular interest due to high chemical diversity and previously reported bioactivity against fungi, yeast and bacteria. An endosymbiotic PE14-07 bacteria identified as Pseudovibrio sp. based on 16S rRNA sequence analysis isolated from a Hamacantha (Vomerula) esperioides marine sponge, showed bioactivity against the multi-drug resistant Escherichia coli 1699, B. cereus, Staphylococcus epidermis, Pseudomonas putida, Aspergillus fumigatus, Mycobacterium aurum, Candida albicans and anti-inflammatory activity. The genome of PE14-07 was sequenced to identify the pathways responsible for the observed bioactivity. antiSMASH analysis identified seven
putative biosynthetic gene clusters. A 39 kb NRP pathway was selected for further investigation to establish whether it was responsible for any of the observed activities. The pathway was cloned into Escherichia coli using the Transformation-associated recombination (TAR) cloning technique. Transformants were screened by Polymerase chain reaction (PCR) to confirm the successful cloning of the NRP pathway. The methanol crude extract of the Escherichia coli-NRP showed activity against B. cereus and S. epidermis. The Escherichia coli-NRP crude extract is currently undergoing chromatography purification for structural elucidation purposes.

30. PURIFICATION AND CHARACTERIZATION OF A TEMPERATE BACTERIOPHAGE LYSIN ACTIVE AGAINST PAENIBACILLUS LARVAE, THE HONEYBEE PATHOGEN IN THE WESTERN CAPE

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Honeybees play a critical role in the world’s agricultural production and therefore are important for ensuring food security. However, Paenibacillus larvae, the bacterium which is the causative agent of American foulbrood (AFB) disease, has drastically reduced the population of honeybees, worldwide. Currently in the Western Cape there is a 40% loss of the native honeybee’s population – Apis mellifera capensis since 2009. Due to the virulence, easy transmissibility, acquired antibiotic resistance and the resilience of the P. larvae spores, it has been difficult to eradicate AFB disease in infected hives. Therefore, a phage-based treatment is under investigation as a potential alternative to combat P. larvae infection of A. mellifera capensis. The genomes of two P. larvae strains, isolated from honeybee combs showing positive clinical symptoms of AFB disease in the Western Cape, have been sequenced. Genome sequence analyses using the PHASTER database predicted more than six different intact temperate phage regions for each strain. Transmission electron microscopy confirmed that some of the temperate phages spontaneously excise during liquid culturing. One of six putative endolysin genes identified from the genomes of the P. larvae temperate phages was targeted for recombinant expression and characterization. The purified endolysin shows selective lytic activity against the P. larvae without affecting the growth of a number of other commensal honeybee larval microbiota. Moreover, the lytic activity of the purified enzyme is unaffected in a range of pH that matches environmental conditions. These results suggest that this temperate bacteriophage endolysin has the potential for future AFB disease treatment.

31. DENATURED CYTOCHROME C ELECTRON TRANSFER INTERACTIONS TO ENHANCE NOX DETECTION

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NO₂ has been identified as the largest ozone-destroying gas of anthropogenic origin it also plays a key role as a molecular messenger in biological systems. In order to investigate each of NO’s functions in living systems the dynamic behaviour of NO should be analyzed. However, it is quite difficult to detect NO directly in aqueous systems. The difficulties are caused by the instability of NO in aqueous solutions and its high reactivity with various
molecules. Biosensors on the other hand are generally developed for the detection of analytes in the liquid phase, particularly in aqueous phase that is close to the physiological environment of the biomolecules used. The strength of biosensors is their high selectivity due to the specific interaction between the biomolecule receptor and the analyte. Using biosensors for gas-phase analysis possess specific challenges mainly related to the analyte transfer from the gas to the liquid phase, and to the chemical and physical processes in which the analyte is involved. Cytochrome C has been proven to be a robust suitable sensor platform for gas biosensing however the pH of the aqueous sensor compartment must be kept around pH 7 and salt concentrations at physiologic concentrations or below to prevent desorption of cytochrome C from the sensor plate. Fixing these proteins to an electrode surface without affecting the integrity of the protein makes up a major component of this approach. Previous studies have identified electron transfer limitations with this concept which has been overcome since with polypyrrole at the focal point of this research. However, these hybrid materials are still subject to various limitations which forms part of the core of this study.

32. SMART CITIES POLLUTION MONITORING SYSTEM (Networking Layer)

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Air pollution has become a constant topic in our daily lives. This paper presents a reasonable solution for the data transmission in air pollution monitoring. Most of the devices that monitor air quality are costly and have limited features. The aim of this project is to provide a cheaper solution that uses Arduino micro-controller boards as the foundation, combined with specific sensors to facilitate transfer of data reliably and effectively. Most traditional air pollution monitoring equipment and similar projects use memory cards as a medium for data storage, whereas this research shows a new idea to stably transfer data to the server by using the Bluetooth, Wi-Fi and cable connections. The connection method is selected automatically by the network selection algorithm defined in the Arduino board. The final data will be presented to the user through a mobile application and website interface effectively and intuitively after being processed in the server. This data transfer system can effectively reduce the cost and input of human resources. Modularity and cost-effectiveness are fully considered when designing the system. It is a viable solution. We can generalize the system by slightly changing the data transmission modules. In this was it can be used as a platform for similar data transmission and offer help for other research directions.

33. VECTOR BORNE DISEASE MODELLING FROM A MATHEMATICAL PERSPECTIVE

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Mathematical modelling and simulation is playing a pivotal role for many diseases affecting humans. Using mathematical modelling one can inform public health departments or practitioners about possible interventions by studying how diseases progress. Such interventions are studied through identification of relevant parameters that are used to design
mathematical models. In this talk, we will present a general ideology via a typical class of vector borne disease which is being studied as part of my Masters thesis.

34. PRODUCTION AND CHARACTERISATION OF MONOCLONAL ANTIBODIES AGAINST POTAMONAUTES PERLATUS VITELLOGENIN

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Environmental levels of anthropogenic pollutants, such as endocrine disrupting chemicals (EDCs), are an increasing health concern. EDCs bioaccumulate in organisms where they can interfere with the activity, transport, and metabolism of endogenous hormones. Vitellogenin (VTG), a female-specific precursor to the egg yolk protein vitellin (Vn), is produced in response to endogenous oestrogens and an established biomarker for oestrogenic EDC exposure in certain vertebrate models. The VTG gene is present in males, but silent. Despite occupying a large number of aquatic habitats and constituting approximately 95% of all living organisms, crustaceans have received very little attention regarding endocrine disruption. *Potamonautes perlatus* belongs to one of the most widely distributed genera of freshwater crabs in Africa, and is widespread in South Africa. Monoclonal antibodies were produced against Vn purified from ovaries of vitellogenic *P. perlatus* females. The antibodies were able to recognise the native form of both VTG and also Vn. The anti-Vn monoclonal antibodies were used to screen haemolymph samples for VTG using Western Blots. Data obtained was confirmed using lipid staining (Oil Red O) and lectin blotting (Concanavalin A) for VTG. The antibody reacted only with VTG in female haemolymph and Vn in the ovaries, but no VTG was detected in male haemolymph, consistent with previous findings. These results confirm the specificity of the antibody for both VTG and Vn. Due to the specificity of the antibody, it can potentially be used in bio-assays to monitor the effects of oestrogenic environmental pollutants on VTG.

35. THE EFFECTS OF CARICA PAPAYA SEED AQUEOUS EXTRACTION ON TM4 SERTOLI CELL LINES

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*Carica papaya* seeds are used in traditional medicine as a male contraceptive. Therefore, the aim of this study was to investigate the parable inhibitory effects of these seeds on TM4 Sertoli cells. *Carica papaya* seeds were ground to powder, of which 5g were added to 600 ml of distilled water. This mixture was then heated for 72 hours to 72°C. Thereafter, the remaining water containing the seed debris was filtered using filter paper grade 393. The aqueous extract was frozen at -20°C and subsequently freeze-dried. After freeze-drying, the powdery extract was used to make up the following concentrations in Dulbecco’s Modified Eagle medium supplemented with 10% fetal bovine serum and 1% penicillin-streptomycin: 0.00025, 0.00025, 0.0025, 0.025, 0.25, 2.5, 25, 250 and 2500 µg/ml. TM4 cells were treated with all concentrations for 24, 48, 72 and 96 hours in 24 well plates. All the experiments were replicated 4 times. Thereafter, media was collected and used for pH measurement. TM4 cells
were trypsinated and stained with 0.2% trypan blue. Results showed no difference for the pH. While the total number of cells after the different time intervals decreased (24 hours for the concentrations of 2500 μg/ml, 48 hours for concentrations of 2500, 250, 25 and 2.5 μg/ml, 72 hours for concentrations of 2500, 250, 25, 2.5 and 0.25 μg/ml, 96 hours for concentrations of 2500, 250, 25, 2.5, 0.25 and 0.025 μg/ml) (P<0.05), while viability was not affected. In conclusion, Carica papaya aqueous seed extract decreases cell growth and thus displays an inhibitory effect on Sertoli cells.

36. THE EFFECT OF NIGELLA SATIVA OIL AND METFORMIN ON WEIGHT AND MALE REPRODUCTIVE FUNCTION IN WISTAR RATS FED AN OBESOGENIC DIET

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Obesity is associated with poor reproductive parameters in males, and oils of Nigella sativa (Ns) show evidence indicating therapeutic benefit for obesity management. The aim of the study was to investigate the impact of Ns on male reproductive organ weights and semen parameters in obese rats. Adult male Wistar rats (n = 9 per group) were fed an obesogenic diet for 14 weeks. Intervention was force fed for the last 8 weeks: saline, metformin (75 mg/Kg/day), low dose Ns (200 mg/Kg/day) (NS200) and high dose Ns (400 mg/Kg/day) (NS400) groups with additional control. Following cervical dislocation, weights (total body weight, omentum, prostate, testes and epididymis) and semen analysis was done. Metformin, NS200 and NS400 significantly reduced total body weight, as well as prostate and epididymis weights. Although omentum weight was decreased in all experimental groups, only NS200 was significant. All treatments caused an increase is sperm concentration; however, this was significant only for metformin. No significant changes for sperm motility (progressive; non-progressive; static) or vitality were observed in any group. Percentage of sperm with damaged MMP was significantly lowered in the metformin and NS400 groups. Ns is associated with weight loss and decreased omentum and reproductive organ weights, comparative to metformin, in obese male rats. However, this had limited effect on sperm parameters in the experimental groups, with only sperm concentration notably increased and a positive impact on MMP. Metformin specifically may have an important role in treatment of male reproductive dysfunction associated with obesity.

37. TYPHA CAPENSIS—AN ELECTRON RICH RESOURCE FOR THE SYNTHESIS OF PHYTOCHEMICAL-ENCAPSULATED GOLD NANOPARTICLES THROUGH GREEN NANOTECHNOLOGY

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Typha capensis is a source of antioxidants, potentially serving as a reservoir of electrons to transport them into gold salt for the production of nanoparticles through green nanotechnology. This study aimed at utilizing the antioxidant capacity of *T. capensis* for the synthesis of nanoparticles, encapsulated with phytochemicals, for effective delivery as novel nanomedicines.

Optimal gold nanoparticle protocols were investigated and particles characterized by measuring the Plasmon wavelength, hydrodynamic size, zeta-potential and visualised by TEM. Average particle size distribution was calculated, and the *in vitro* stability in various media tested.

*T. capensis* produced nanoparticles playing a duel role of reducer and stabilizer, peaking at 540 nm. Particles were stable, no deterioration when washed or during *in vitro* stability studies. An average hydrodynamic size of 120.2 nm and average zeta-potential of -23.2 mv was measured. TEM showed spherically shaped, un-agglomerated particles with an average particle size of 27.9 nm.

Highly stable gold nanoparticles, encapsulated with *T. capensis* phytochemicals, have been synthesized through a single step. The potential of delivering phytochemicals from *T. capensis* through nanoparticles for the treatment of prostate cancer is being tested.

38. POINT SOURCE SIMULATIONS AND FOREGROUND CLEANING TECHNIQUES FOR HI INTENSITY MAPPING

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We created a full sky realistic point source catalogue using NRAO VLA Sky Survey(NVSS), Sydney University Molonglo Sky Survey(SUMSS), and SKADS Simulated Skies(S-cubed) at a frequency of 1400 MHz. S-cubed is part of a suite of an online database of a semi-empirical simulation of radio emission, which traces the underlying dark matter using extrapolated luminosity functions. The catalogue was successfully simulated in total intensity and polarization down to a flux density of 10 microJy. The catalogue was extrapolated to a generic frequency range (850, 1000) MHz and HEALPix pixelated. The point source maps created are smooth in frequency. The point source maps were combined with HI intensity, foregrounds, and noise maps. The noise maps are MeerKAT-like since they overlap with Dark Energy Survey(DES) region and the instrumental parameters used are those expected for a MeerKAT survey. Case 1: total intensity without polarized Galactic synchrotron. Case 2: Foreground considered is only the polarized Galactic synchrotron. For both these cases, the polarization leakage fraction is 1%. To recover the HI signal we used foreground separation techniques relying on tweaking one parameter, the number of degrees of freedom(DOF). DOF denotes the modes to be removed in order to recover the cosmological signal. Using foreground subtraction methods, mainly Principal Component Analysis, we showed that removing seven modes is enough in recovering the HI signal for case 1. In case 2, DOF < 60 does not work(while DOF > 84 the signal depletes). More accurate maps of the polarized Galactic synchrotron are required. With SKA telescopes being built, intensity mapping will flourish in precision cosmology.
39. OPTIMISATION OF INORGANIC-ORGANIC PHOTOACTIVE HYBRID FILM FOR PHOTOVOLTAIC APPLICATION

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Photoactive hybrid films based on inorganic/organic nanocomposites have attracted a lot of attention for fabrication of low cost and environmental friendly off grid photovoltaic devices. In particular, silicon nanowires (SiNWs), electron accepting materials and poly (3-hexylthiophene) (P3HT), electron donor conjugated polymer are promising candidates due to high optical absorption and excellent charge carrier mobility associated with them respectively. An objective of the study was to establish optimised spin coating conditions for P3HT film deposition with high film uniformity and electrical conductivity in order to incorporate SiNWs for enhancement of optical and electrical properties of the film. Spinning speed, duration and solution concentration were studied as experimental parameters. Uniform films with satisfactory electrical conductivities were obtained.

40. SURVEYING THE INFLUENCE TESTS HAS ON STUDENTS’ ATTITUDE TOWARDS PHYSICS AND LEARNING OF PHYSICS

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Acquiring Physics knowledge of undergraduates comes with lots of anxiety and apathy on the part of most students. Examinations have a major influence on the approach to studying physics and hence have an effect on the students’ performance. Many students may stay away from lectures, however, they will do everything possible to attend tests and examinations. The influence of examinations on students can be used to drive the process of learning physics.

This paper reports on a study investigating the influence tests has on students’ attitude towards physics and learning of physics, in the first year mainstream mechanics module, PHY111, in the Department of Physics at the University of the Western Cape. In this presentation an overview will be given of how tests are used in the PHY111 module to drive and focus student learning as well as the findings of a survey of the influence tests has on students’ attitude towards physics and learning will be presented and discussed.

41. ELECTRICAL RESISTIVITY AND THE THERMODYNAMIC PROPERTIES OF THE FERROMAGNET Nd$_2$PT$_3$In

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The ferromagnet Nd$_2$Pt$_2$In compound was investigated by means of electrical resistivity, $\rho(T)$, magnetic susceptibility, $\chi(T)$, magnetization, $M(\mu_0H)$, heat capacity, $C_p(T)$ and magnetocaloric effect (MCE). Powder X-ray diffraction results confirm the tetragonal Mo$_2$FeB$_2$ type crystal structure with space group $P4/mnbm$ (No.127). At high temperatures, $\rho(T)$ data shows metallic behaviour with a downward curvature and that is described by the Bloch – Gruneisen – Mott’s relation. At low temperature, $\rho(T)$ data shows an anomaly associated with ferromagnetism phase transition at $T_C = 18$ K. below $T_C$, $\rho(T)$ is well described by a spin – wave dispersion with energy gap, $\Delta = 15.7(9)$ K. $\chi(T)$ data at high temperature follows the Curie – Weiss relationship given and effective magnetic moment value, $\mu_{\text{eff}} = 3.61(2) \mu_B$ and the Weiss temperature constant $\Theta_p = 16(1)$K. The observed $\mu_{\text{eff}}$ is close to the value of 3.62$\mu_B$ expected for the Nd$^{3+}$ ion. At low temperature, $\chi(T)$ data exhibit a sharp rise characteristic of ferromagnetic (FM) materials. $T_C$ was estimated at the maximum of $d\chi(T)/dT$ curve at $T_C = 17.8$ K, which is close to the value of 18 K observed in $\rho(T)$ data. $C_p(T)$ data confirms the FM phase transition at $T_C = 17.9$ K taken at the midpoint of the maximum slope of the $\lambda$-type anomaly and close to the values of 18 K and 17.8 K observed in $\rho(T)$ and $\chi(T)$ data respectively. The $4f$ – electron specific heat $C_{4f}(T)$, indicates a schottky – type anomaly at high temperatures associated with crystalline – electric – field (CEF). The MCE estimated from the magnetization data gives a value of 6.25 J/kg.K for a field change of 7T. The isothermal magnetic entropy change maximum ($\Delta S_M^{\text{max}}$) follows a linear behaviour with $h^{2/3}$ ($h$ being the reduced field) with a negative $y$ – intercept, which confirms the mean – field theory for a second – order phase transition.

42. INVESTIGATION OF METAL OXIDE THIN FILMS FOR THEIR APPLICION AS BUFFER LAYERS IN HYBRID ORGANIC PHOTOVOLTIACS

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In this study metal oxide thin films were deposited on glass substrates. An investigation of metal oxide layers such as zinc oxide (ZnO) and titanium dioxide (TiO$_2$) was performed. The purpose of the buffer layers is to serve as electron collecting layers. TiO$_2$ is versatile since it can also act as a hole blocking layer. Buffers layer improve the efficiency as well as the performance of polymer solar cells since they enhance the stability of a solar cell. The application of these thin films was done by means of sol-gel processing. The spin coating method was employed to deposit the ZnO and TiO$_2$ layers from pre-cursor solutions. Two types of annealing were performed, one type by pre-heating the thin films at 250 °C on a hot plate followed by annealing in ambient air at 500 °C, whereas the second type involved ramp annealing at 25 °C/min from room temperature to 275 °C. This was done in order to study the effect on the morphological properties of the thin films. The surface morphology and elemental analysis of the prepared samples were studied using scanning electron microscopy (SEM). The optical properties were measured using UV-Vis spectroscopy where it was found that the average transmittance of the thin films ranged from 65 % - 87 % in the visible range. These preliminary results showed that it is feasible to deposit ZnO films and TiO$_2$ films from solutions.
43. SEQUENTIAL CVD DEPOSITION OF ORGANIC-INORGANIC TRI-HALIDE PEROVSKITES

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Organic–inorganic tri–halide semiconductor hybrid perovskites have gained an intensive interest by researchers for application in the photovoltaic field with potential of becoming the new generation of solar cells for renewable energy generation. This new interests is motivated by a highly increased power conversion efficiency (PCE) of the laboratory cells over the past 8 years from 3.8% in their first application in 2009 to more than 20% certified PCE. The primary compound of interest is methyl ammonium (organic) lead (metal) iodide (halide) (MAPbI₃) or slightly chloride doped version (MAPbI₃₋ₓClₓ, x = 1 – 2). The high efficiency of hybrid perovskites is attributed to some of its excellent properties such as high optical absorption coefficient (ca. 10⁴ cm⁻¹) including wide range of visible absorption range (400 – 750 nm), long carrier diffusion lengths (ranging between 100 nm for MAPbI₃ and 1 µm for MAPbI₃₋ₓClₓ), low intrinsic recombination rates, composition depended tuneable direct band gap (1.5 – 2.3 eV), high crystallinity and low temperature processing.

The main explored deposition method is spin coating from a solvent solution followed by thermal evaporation. Chemical vapour deposition (CVD) is known to be a good system for thin film deposition but has under explored by the perovskite community. This project makes use of the two–step CVD to deposit highly crystalline MAPbI₃ perovskite with films of comparable if not greater quality than thermal evaporation. The thin films were investigated by XRD for crystallinity, electron microscopy for morphology and UV-Vis spectroscopy for optical properties.

44. MAPPING THE NEAR-INFRARED COUNTERPARTS OF RADIO SOURCES

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In this study we investigate the near-infrared (NIR) properties of radio sources. We do this by cross-matching the Sydney University Molonglo Sky Survey (SUMSS) radio catalogue at 843 MHz with the VISTA Hemisphere Survey (VHS) NIR catalogues. Science goals include identifying powerful high redshift radio sources for absorption line studies with MeerKAT. Historically most of the follow up (with optical/NIR imaging and spectroscopy) has been conducted on northern hemisphere samples. This is all fine astrophysically as there is no expectation that there are may be any difference between northern and southern hemisphere for extragalactic objects, but it is problematic as all the best observing facilities are now in the southern hemisphere (e.g. MeerKAT/SKA). This sample is essential for studies of bright AGN and high redshift.
45. PRIORITIZING SNPS USING THE NEO4J GALAXY INTERACTIVE ENVIRONMENT

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Graph database implementations are increasingly being used within the biomedical research space, (e.g. disease-knowledge-base). We previously developed a `neostore` datatype and a Neo4j Galaxy Interactive Environment (IE) for storing and exploring Neo4j graph databases within the Galaxy scientific workflow system. Building on this work we generate a *M. tuberculosis* (M.tb) genome database from multiple public sources of annotation. To try and bring some consistent semantics, the database follows a Chado-like `schema` with graph nodes and relationships between them named according to sequence ontology terms. Thus, making it natural to the researcher to make queries using the Cypher query language. NGS data is processed to yield novel variants that are stored in the database using a schema derived from the GA4GH variant model. Using the resultant Neo4j database and Cypher queries in the context of M.tb drug resistance, we are able to prioritize SNPs for further experimental investigation of their association with multi-drug resistance in M.tb.

46. GENOME SIZE ESTIMATION OF ROOIBOS

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Rooibos is one of the few endemic South African medicinal plants with international importance. Understanding the genomic background with regards to genes involved in medicinal compound production and stress tolerance promotes agricultural production and bioprospecting. A prerequisite for genome sequencing is the analysis of the genome size. This can be performed using DNA Flow Cytometry. For each plant species, the appropriate plant tissue and nuclei isolation buffer have to be determined. Here, we tested three isolation buffers (Partec, LBO1 and woody plant buffer) on different plant tissues (roots, cotyledons and leaves) for best resolution of genome size in DNA Flow Cytometry analysis. To evaluate the quality of the peaks and the effectiveness of the method we measured %Coefficient of Variance, debris background factor, side scatter and number of nuclei released. Our findings show that best results were achieved using woody plant buffer on rooibos leaves. The estimated genome size of rooibos is 3 Gb.

47. BAOBAB LABORATORY INFORMATION MANAGEMENT SYSTEM: DEVELOPMENT OF AN OPEN-SOURCE LABORATORY INFORMATION MANAGEMENT SYSTEM FOR BIOBANKING

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A laboratory information management system (LIMS) is central to the informatics infrastructure that underlies biobanking activities. To date, a wide range of commercial and open-source LIMSs are available and the decision to opt for one LIMS over another is often influenced by the needs of the biobank clients and researchers, as well as available financial resources. The Baobab LIMS was developed by customizing the Bika LIMS software (www.bikalims.org) to meet the requirements of biobanking best practices. The need to implement biobank standard operation procedures as well as stimulate the use of standards for biobank data representation motivated the implementation of Baobab LIMS, an open-source LIMS for Biobanking. Baobab LIMS comprises modules for biospecimen kit assembly, shipping of biospecimen kits, storage management, analysis requests, reporting, and invoicing. The Baobab LIMS is based on the Plone web-content management framework. All the system requirements for Plone are applicable to Baobab LIMS, including the need for a server with at least 8 GB RAM and 120 GB hard disk space. Baobab LIMS is a server-client-based system, whereby the end user is able to access the system securely through the internet on a standard web browser, thereby eliminating the need for standalone installations on all machines.

48. A NOVEL METHOD FOR DETECTING ASPALATHIN IN ROOIBOS (ASPALATHUS LINEARIS) PLANT- AND TEA EXTRACTS

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The main polyphenol found in rooibos (Aspalathus linearis) is aspalathin which is unique to rooibos and may be involved in the teas unique health promoting properties. During fermentation, aspalathin is broken down to other compounds, resulting in a red color and a reduced aspalathin content. Popularity for unfermented rooibos tea, also known as green rooibos tea, has increased, due to a growing health conscious market. Up until now, only near-infrared spectroscopy has been described as an effective way to distinguish between green and fermented rooibos tea. However, this method requires expensive equipment and extensive expertise. An easier, more cost effective method was developed, that can reproducibly detect aspalathin at concentrations as low as 200 ng, in plant- and tea extracts. Samples are analysed by thin-layer chromatography, followed by p-anisaldehyde derivatization. Aspalathin is uniquely derivatized to an orange/brown color, which is easily distinguishable with the naked eye. This method was able to detect that three out of our eight diverse rooibos ecotypes did not contain aspalathin. It was also able to distinguish between green and fermented tea in the extracts of eight commercially available tea brands (six fermented teas and two green teas).

49. STRUCTURAL AND FUNCTIONAL EFFECTS OF NUCLEOTIDE VARIATION ON THE TUBERCULOSIS DRUG METABOLIZING ENZYME HUMANARYLAMINE N-ACETYLC-TRANSFERASE 1

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The human arylamine N-acetyltransferase 1 (NAT1) enzyme plays a vital role in determining the duration of action of amine-containing drugs such as para-aminobenzoic acid (PABA) by influencing the balance between detoxification and metabolic activation of these drugs. Recently, four novel single nucleotide polymorphisms (SNPs) were identified within a South African mixed ancestry population. Modeling the effects of these SNPs within the structural protein was done using molecular dynamics simulations and stability predictions which indicated less thermodynamically stable protein structures containing E264K and V231G, while the N245I change showed a stabilizing effect. Principal component analysis indicated that two amino acid substitutions (E264K and V231G) occupied less conformational clusters of folded states as compared to the WT and were found to be destabilizing (may affect protein function). Furthermore, two of the four novel SNPs that result in amino acid changes: (V231G and N245I) were predicted by both SIFT and POLYPHEN-2 algorithms to affect NAT1 protein function, while two other SNPs that result in R242M and E264K substitutions showed contradictory results based on SIFT and POLYPHEN-2 analysis. In conclusion, structural methods were able to verify that two non-synonymous substitutions (E264K and V231G) can destabilize the protein structure, and are in agreement with mCSM predictions, and should therefore be experimentally tested for NAT1 activity. These findings could inform a strategy of incorporating genotypic data (i.e., functional SNP alleles) with phenotypic information (slow or fast acetylator) to better prescribe effective treatment using drugs metabolized by NAT1.

**50. SOCIOECONOMIC INEQUALITY TRENDS IN THE USE OF SKILLED HEALTH PROVIDERS IN SIERRA LEONE, 2008-2013**

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Health inequality is a common phrase used to label inequalities in health among populations. Evidence-based research into many aspects of health inequalities has provided policy-makers and other relevant stakeholders with means of understanding and putting measures in place to reduce such health inequalities. For the purpose of this study (using Sierra Leone Demographic and Health Surveys, 2008 and 2013), the researcher focused on one outcome indicator (skilled birth attendance) in order to understand the extent of maternal health inequalities in the country. As a poor country, economic inequalities are expected, but there is no empirical evidence to show the extent of these inequalities in the use of maternal health services in Sierra Leone. The study makes use of equity measures which are well-known in population health and epidemiological studies (i.e. rate ratios and rate differences, as well as concentration indices and concentration curves). The preliminary findings show that women...
with a higher socio-economic standing tend to use skilled birth attendants more compared to their counterparts who have a lower socio-economic standing. Furthermore, the concentration indices show a decrease from 2008 to 2013, which suggest that the inequalities in skilled birth attendance have decreased over time.

51. CORRELATES OF AGE AT MARRIAGE AND BIRTH INTERVAL IN ETHIOPIA: A SURVIVAL ANALYSIS

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Age at first marriage have a significant effect on first birth interval. This study investigates the relationship between age at first marriage to first birth interval and its associated factors in Ethiopia. The objective of the study is to examine the estimated age at first marriage to first birth interval and its main associated factors by age at first marriage and place of residence in Ethiopia. Data from the Ethiopia Demographic and Health Survey (EDHS) 2011 was used. Cox Proportional Hazard model is used to determine the significant factors contributing towards age at marriage to first birth interval in Ethiopia. The findings from the Cox proportional hazard model indicate that age at first marriage, religion, region, educational level and work status are the most important significant covariates of ‘age at first Marriage to first birth interval’ in Ethiopia. Hazard ratio of marriage to first birth interval of young women by age at marriage 15-19 and 20-24 who belongs to Muslim religious affiliation were (HR=1.22, CI (1.09-1.37)) and HR=1.13, CI (1.03-1.24)) respectively. This indicate that young women age at marriage 15-19 and 20-24 who belongs to Muslim religious affiliation have 22% and 13% higher risk of being a mother than those of Christian religious affiliation. Age at first marriage of women and their socio-economic factors contribute to differences in first birth interval. On the other hand, in Muslim dominated region such as Somali the time of transition to motherhood is early due to their religious belief.