RENAME2028 | Detection of Exosomal MicroRNAs Using Rolling Circle Amplification on Microfluidic Chip

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Objectives: Detection of exosomal microRNA (miRNA) is extremely important for screening of exosomes. However, the trace amount of miRNAs in exosomes hampered the traditional detection method of miRNAs. An amplification method was needed for the detection of exosomal miRNAs.
Methods: We developed a rolling circle amplification (RCA) based method of detecting exosomal miRNAs on microfluidic chip. The microfluidic chip was designed with two reaction cells and a detection cell connected by a channel. After the exosomes were injected into the microfluidic chip, the lysate was added for collecting the miRNAs inside. Then the padlock designed for the target miRNA was injected with ligase. The ligation was carried out in the first reaction cell of the chip. After the formation of circular DNA, the polymerase and dNTPs were injected. The RCA reaction was conducted in the second reaction cell. Finally, the product was pushed to the detection cell, where the specific molecular beacons (MBs) were added to detect the target miRNA sequence. When hybridized with the target miRNA, the hairpin shaped MBs were opened to release the fluorophore from the quencher. Thus the recovered fluorescence intensity of the MB implied the target miRNA concentration.
Results: MiRNA-21 (miR-21) was chosen as the target in the assay. Exosomes from Huv and MCF7 cell lines were used for the detection. The two kinds of exosomes were added in two identical microfluidic chips for comparison. The detected intensity of MB from MCF7 exosomes was approximately 2.5 times of that from Huv exosomes, which referred to the exosomal miR-21 concentration ratio of the two kinds of cell lines.
Conclusions: The intensities of miRNA RCA product from different kinds of exosomes can be useful in distinguishing exosomes. The miRNA concentration varied from different cells. Even the exosomes secreted from the same cancer cell might contain distinct concentrations of one miRNA due to the different stages of development. Therefore, the detection of exosomal miRNAs played an important role in the cancer diagnosis. With the excellent sensitivity, the RCA method could be a promising method for detecting exosomal miRNAs, which is of vital importance in clinical applications.
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RENAME2029 | Automatic Malignant Thyroid Nodule Recognition in Ultrasound Images by Variational Autoencoder and CNNs

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Objectives: As the most common malignancy in the endocrine system, thyroid cancer is usually diagnosed by discriminating the malignant nodules from the benign ones using ultrasonography, whose interpretation results primarily depends on the subjectivity judgement of the radiologists. In this study, we propose a novel cascade deep learning model to achieve automatic objective diagnose during ultrasound examination for assisting radiologists in recognizing benign and malignant thyroid nodules.
Methods: All images of the dataset used in the study were collected using the ultrasound machine (Phillips, HITACHI, GE) with the probe frequency set as 5–17 MHz and labeled by the doctors of Peking University Third Hospital. A total of 3771 thyroid nodule ultrasound images were collected from 2360 patients after surgery or Fine Needle Aspiration (FNA), among which 1316 are benign and 2455 were malignant. All the thyroid instances involved in this dataset have been examined via pathological examination and cover patients of different ages as well as nodules of different sizes. First, the simplified U-net is employed to segment the region of interesting (ROI) of the thyroid nodules in each frame of the ultrasound image automatically. Then, to alleviate the limitation that medical training data are relatively small in size, our designed CVAE is trained by learning the probability distribution of ROI images conditioned on a latent variable and the corresponding labels to generate new images for data augmentation. Thus, ResNet50 can trained with both original and generated ROI images. As consequence, the deep learning model formed by the trained U-net and trained Resnet50 cascade can achieve malignant thyroid nodule recognition in clinical applications.
Results: The proportion of training set and test set is 8:2. The pre-trained Resnet50 was trained 10 epoches on the original ROI image dataset and achieved 0.853 accurcy, 0.923 sensitivity, 0.824 specificity on the test set, which outperforms that of fine-tuned Inception V3 and MobileNet. The generated ROI images including 950 malignant ones and 50 benign ones are produced by the improved conditional variational Auto encoder. When they are added to the original ROI image training dataset to retrain the Resnet50, the accuracy

with ResNet50 increases to 0.874 and 0.92 sensitivity, 0.868 specificity is achieved.

Conclusions: The proposed cascade deep learning model consisted of trained U-net and trained Resnet50 can achieve malignant thyroid nodule automatic recognition in clinical applications. Specially, the experiment results revealed the effectiveness of the improved Conditional Variational Auto Encoder in ROI image data augmentation.

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XU6300 | Effect of Sorbitan Monopalmitate on Crystallization Behavior of Palm Oil

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Objectives: This paper aims to study of changes in the crystallization behavior of palm oil after the addition of commercial emulsifier containing pure Span40 (>99%), gain more insight into the effect of emulsifier on the palm oil crystallization behavior, and improve the possibility for using palm oil as ingredient In a wider field.

Methods: Preparation of the model shortenings Span40 (1%, 2% and 4% W/W) were dispersed in he melted palm oil and stirred with a magnetic stirrer at 80 ± 0.5°C for 30 minutes to erase the crystal memory until a homogeneous sample was obtained. Each sample was put in a freezer at −20°C for 30 minutes. The fat samples were subsequently stored at 25 ± 1°C until analysis. The crystallization behavior of these samples was evaluated by differential scanning calorimetry (DSC), X-ray diffraction and polarized light microscopy (PLM).

Results: From the DSC results, two exothermic peaks can be seen in the range of 1°C to 30°C. The addition of Span40 promoted the process of crystallization of PO, leading to higher temperatures (onset, peak and endset) compared to pure PO, and the greater concentration of span40 is, the earlier onset of crystallization. PO with added Span40 required higher temperatures to attain complete crystallization leading to reduced crystallization enthalpies. Wide angle diffraction peaks emerged at 4.3, 4.2, and 3.9 Å. Small-angle diffraction peaks at 42.4 and 14.1 Å. This crystalline phase was called β′. PLM results indicated a smaller spherulites structure through addition of Span40 to PO which yielded a coarser crystal structure.

Conclusions: On the basis of DSC results, it was clear that the addition of Span40 leads to an earlier onset of crystallization of PO. Combined with the results of the XRD measurements, it was suggested that the high-melting Span40 initiated the crystallization process and induced a fractional crystallization of the PO triacylglycerols, leading to a concentration of similar TAGs around span40 cores. The PLM results indicated a smaller crystal structure through addition of Span40 to PO, and this effect improved the possibility for using palm oil as ingredient.

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